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ABSTRACT

This curriculum guide is an aid to administrators and instructors of industrial arts and vocational-technical school programs for the development of meaningful curriculum in plastics. The materials are intended for use at four levels: level I, exploring plastic technology; Level II, basic plastic technology; and levels III and IV, applied plastic technology. Introductory materials include a plastic technology teaching strategem, objectives of an industrial arts education program and of plastic education, listings of the behavioral objectives for the four levels, and a brief discussion of safety. The curriculum consists of nine units: plastic industry in perspective, synthetic material technology, product design, finishing and decorating of plastics, plastic converters, plastic fabrication, quantity production processes, manpower and the plastics industry, and the plastics industry in perspective, revisited. Each unit is presented in a column format in which topics (curriculum content) are correlated with level, teacher activities, and student activities. A plastics bibliography follows. Appendixes include annotated listings of films, slide and cassette materials, filmstrips, and videocassettes; a plastics periodical list; an encyclopedia of associations; lists of general equipment, plastics equipment, and plastics tools; a listing of vendors of plastics supplies and equipment; plastics instructional materials and resources; a chart of career patterns; and a competency profile. (YLB)

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A Curriculum Guide For

Industrial Arts
Plastic Technology

Intermediate and Secondary Level Students

by
Dr. Jack M. Landers
Central Missouri State University
Warrensburg, Missouri

CE039396

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PREFACE

Industrial Plastics

This curriculum guide has been prepared as an aid to administrators and instructors of industrial arts and vocational-technical school programs for the development of meaningful curriculum in plastics. The guide has been divided into three sections: Level I, Level II, and Level III and IV. Suggested curriculum in each level may be added to or deleted from to better fit the needs of students or to match resources and facilities of individual school districts. The goal is to insure that all students enrolled in plastics programs benefit from their experiences.

Specifically, this guide reflects the approach of an instructional management system.[1] Thus, curriculum is organized with general objectives of industrial art education and specific behavioral objectives clearly defined, providing students precise knowledge of what remains to be accomplished. Also, all attempts have been made to correlate this guide to recent national standards developed for industrial arts programs.[2]

Level I, Exploring Plastic Technology, is intended for junior high and/or middle school students who wish an introductory course. The instructor has the opportunity to demonstrate as many concepts and principles as time permits in a nontechnical manner, through the use of traditional shop projects. The purpose is to expose the student to career opportunities in the plastics industry.

Level II, Basic Plastic Technology, is intended for students with a definite desire to know the basics concerning components and circuits. The instructor may utilize a class/lab format to describe theory and operations of passive and active components. This course is designed to provide the background knowledge necessary for students to apply what they have learned.

Level III and IV, Applied Plastic Technology, may be utilized in several ways. The course may normally follow Level III guidelines of product identification and provide students the opportunity to apply their knowledge to a variety of other applications (such as plastic technician), or the units of instruction may be used in an individualized manner for students with special needs or interests. Thus, individualized instructional curriculum can be obtained for most of the units of instruction suggested in Level III and IV.

[1]A copy of "Instructional Management: A Priority for Missouri Schools During the 80's" may be obtained by writing Missouri Department of Elementary and Secondary Education, Industrial Arts Section, P.O. Box 480, Jefferson City, MO 65102.

[2]A copy of the "National Standards for Industrial Arts Programs" may be obtained by writing: AIAA Publications, 1914 Association Drive, Reston, MA 22091. Cost is $4.00.

Recommended Sequence by Levels for Industrial Arts Courses

Level I Grades 6-7-8-9
Exploratory Industrial Arts (General Shop) This course offers a wide range of experiences in a comprehensive general shop, or in several area shops depending on the facilities available. Experiences will be provided which encompass the study of areas such as metals, drafting, electricity, graphic arts, ceramics, power, plastics, woods, and leather.

Suggested Courses or Content Areas	Level II*	Grades 9-10-11-12							
Drafting	Electricity	Graphic Arts	Industrial Ceramics	Industrial Crafts	Metals	Industrial Plastics	Power Mechanics	Woods	Innovations or Combinations

Suggested Courses or Content Areas	Level III	Grades 10-11-12						
Machine Drafting Technical Drafting Architectural Drafting Graphics	Advanced Electricity Electricity/ Electronics Electrical Power	Printing Photography Offset Lithography		Metal Machining Sheet Metal Welding Metal Technology	Plastic Technology	Power/ Systems Aerospace Technology	Wood Machining Wood Technology	Industrial Mechanics

Suggested Content Areas	Level IV	Grades 11-12
Advanced or experimental work in a specialized phase of industrial arts; courses named accordingly. Prerequisite: Level III work in the same area, or special arrangement approved by the instructor.		

*1. Beginning at Level II, students with special interest in the field of Industrial Arts should be encouraged to schedule in their high school programs, according to ability and time, supporting subjects such as Industrial Mathematics, General Physics, Algebra I, elementary Trigonometry, and Geometry I.

2. Students may enter vocational-industrial or technical education courses upon successful completion of related Level II or Level III in industrial arts courses.

ACKNOWLEDGMENTS

Curriculum Guide Committee

Mr. B. Eugene Brightwell, Supervisor of Industrial Arts Education, Department of Elementary and Secondary Education, Jefferson City, Missouri

Mr. Norm Fricke, Industrial Arts Instructor, Boonville High School, Boonville, Missouri

Mr. Peter Koumas, Northeast Missouri State University, Kirksville, Missouri

Dr. Jack Landers, Chairman, Department of Manufacturing and Construction, Central Missouri State University, Warrensburg, Missouri

Mr. Lonnie Moore, Amoco Chemicals Corporation, Warrensburg, Missouri

Mr. Ike Ozgunay, Rival Manufacturing Company, Clinton, Missouri

Ms. Judith Perryman, Industrial Arts Teacher Educator, Springfield, Missouri

Dr. Harley Schlichting, Director, Instructional Materials Laboratory, University of Missouri, Columbia, Missouri

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PLASTIC TECHNOLOGY TEACHING STRATEGEM

In keeping with the philosophy of Industrial Arts, the emphasis of learning should be placed on "doing." Learning should not be based on passive absorption. Students of the plastic science must be given a purposeful, worthwhile activity to complete. They must be challenged both mentally and physically. Unless the student actively performs the assigned task, learning does not take place. Basically, the student will learn about plastics if:

1. the instructor *tells* the student each intricacy of a plastic principle,
2. the plastic principle is *demonstrated* to the student, and
3. the student is required to *perform* the activity.

You, the instructor, must be aware of the varied aspects of learning in order to increase your effectiveness and productivity as a teacher. The ideal learning situation for plastic technology requires freedom to explore the many problems, processes, materials, and career opportunities of the plastic industry.

Learning is the result of conditions of the total personality. Any piece of information or activity will effect a change in behavior if the individual is learning. Learning thus becomes the discovery of personal meaning manifested by a change in mental or physical behavior.

By investigating the nature of learning, the instructor will see that there are many factors to consider in establishing a learning situation. The learner must be introduced to an atmosphere where learning can take place. The learner must then be motivated, be mentally conditioned, to be receptive to the plastic principles being taught. To be successful in teaching plastic technology, the learner's attitude must be considered and/or altered before any learning can take place.

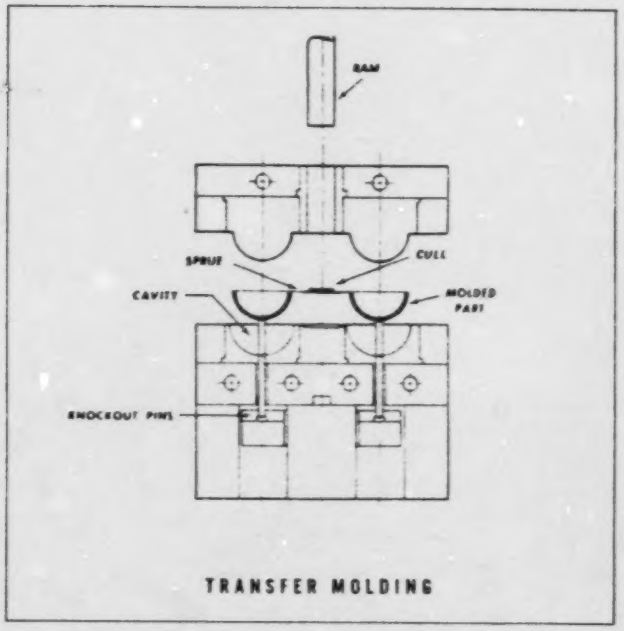
The goal of Plastic Technology Education is centered around three desired outcomes:

1. *the acquisition of knowledge* - this is often designated by the student's acceptance of ideas, concepts, meanings, facts, and principles. Knowledge to be taught through plastic technology involves methods and processes of the industry and facts about the industry which will enable the student to organize, study, criticize, and make judgments concerning their future in a world surrounded by plastic products.
2. *the acquisition of skills* - refers to mental and physical abilities and specific habits by which the student will adapt knowledge of the plastic industry to solve problems. Plastic technology will continue the traditional concept of Industrial Arts by reinforcing knowledge with the "hands-on-experience." Each student will be given the opportunity to perform tasks related to machine operation and product development of the plastic industry.
3. *the acquisition of emotionalized controls* - this includes attitudes, appreciation, interest, ideas, and habits of conduct which are necessary to give value to learning related to the plastic technologies. Many impressions will be formed through plastic education programs which can be carried to effective living - ideas relating to material/energy resources, careers, and environmental protection. Plastic technology can develop cooperative attitudes and self-reliance. Plastic technology will help develop the student's appreciation of the dignity of work and reliability.

Basic Principles of Plastic Technology Learning

The following six principles are generalizations which describe the conditions in which plastic technology learning may take place. These will serve the instructor as guides for selection and use of plastic technologies.

1. **Motivation** - is the very essence of the learning process and one of the instructor's most fundamental problems. The nature of plastic technology is unique to motivation. Students tend to be extremely interested by the topic itself.
2. **Doing** - all students, regardless of age, learn by doing. The instructor must take advantage of this fact by identifying activities for the learner to do, and also to achieve a degree of success. The psychomotor activities will involve student thinking, talking, writing, and problem-solving.
3. **Realism** - the student of plastic technology will respond to ideas which are related to the real world outside the classroom. It is the instructor's responsibility to present plastic technology material in such a manner that the student will use it in actual practice. Second, plastic technology lessons need to be realistic, based on the level and maturity of the class.
4. **Background** - plastic technology learning is based on experience. New experiences are interpreted on the basis of past experiences. The instructor of plastic technology should develop a catalog of plastic products which the student may relate to from daily life.
5. **Appreciation** - this principle is of such importance that it may be considered above any subject discipline. Emphasis is to train individuals, not merely to teach a subject matter. The instructor of plastic technology will recognize that students learn many things from the presentation in addition to materials related to the plastic industry. Plastic products are material goods which represent capital investments to be used and enjoyed. The instructor will employ a positive attitude toward the preparation and use instructional materials.
6. **Objectives** - Learning is most effective when the student is given stated objectives which will direct learning efforts. The instructor will find objectives for plastic technology education that will assist in the preparation of learning materials.



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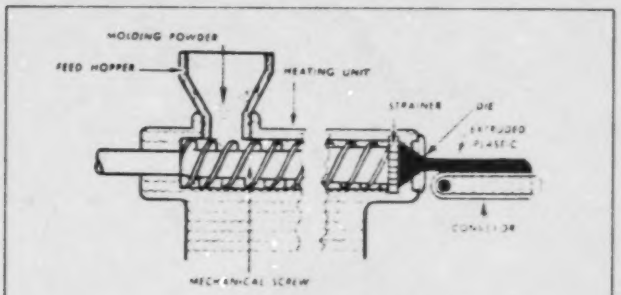

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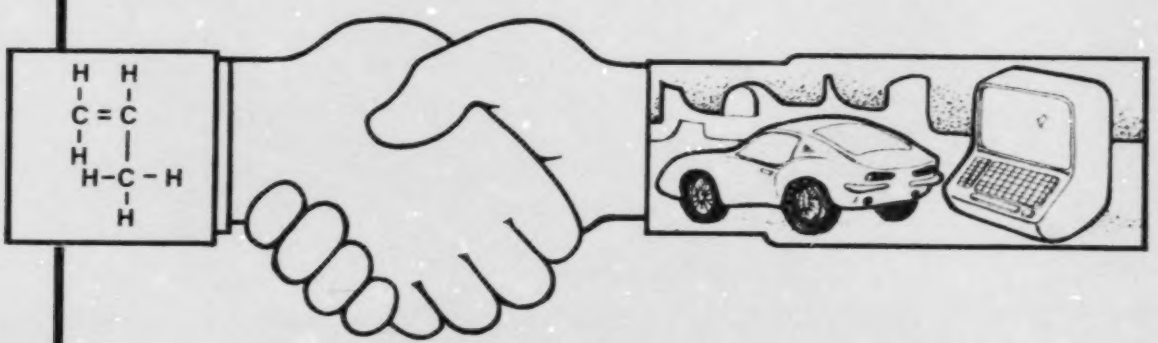

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POINT OF VIEW AND OBJECTIVES

A principle purpose of American education is to assist each individual to develop as a productive member of society. The achievement of this purpose enables the individual to provide for basic needs, to produce more than that individual consumes, and to contribute more than that individual receives. It also involves the development of ideals and goals, the acceptance of social responsibility, and the acquisition of desirable character traits.

Behavioral changes within the individual are effected through experiences and the interpretation of these experiences. The experiences provided by the school permit the acquisition of skills and knowledge which allow individuals to develop to their maximum potential with profit to themselves and society. The learner's interpretation of these educational experiences provides for the further development of desirable character traits which lead to the wise application of the acquired skills and knowledge.

Industrial arts contributes to the purpose of American education by aiding individuals as they gain an understanding of their industrial-technological environment. Experiences in industrial arts must be an integral part of the overall educational program for all students, both male and female, and should be available at all grade levels. The importance of this experience is recognized in Missouri where credit in the practical arts, which includes industrial arts, is a secondary school graduation requirement.

Industrial arts education provides an opportunity for individuals to participate in direct experiences involving industrial skills and processes which foster an awareness of industry in American culture. These experiences are concrete, meaningful, and have educational value as they aid the individual in understanding abstract ideas. These experiences provide opportunities for an individual to apply mathematics, science, art, language arts, and other school subjects in purposeful situations.

Through the application of grouping and special instructional techniques, industrial arts in the secondary school can be organized to meet the needs of students of varying abilities. Individuals expecting to enter professional occupations, as well as future industrial workers, should benefit from industrial arts experiences. The need for industrial arts instruction has little relationship with the economic status of the student. Every person must be aware of and familiar with the concepts taught in industrial arts education to live effectively in our industrial society.

Industrial arts education aids in the discovery and development of personal interests, aptitudes, creative thinking, and technical abilities. Responsible and resourceful actions and judgments are matured through problem solving and self-expression in an environment related to industry. The future scientist or engineer may learn to solve technical problems, and the future technician or craftsman may develop skills and related understanding in industrial arts courses.

Realistic objectives, clearly stated, are essential to a sound program of industrial arts education. The following statements of purpose are fundamental to quality industrial arts education as it provides opportunities for students to:

1. **Develop an insight and understanding of tools, machines, materials, and processes as they relate to the production and servicing aspect of industry.**

The field of industrial arts education is concerned with the study of materials and processes of industry and the creative use of design. Students of industrial arts education have an opportunity to gain a better understanding of mass production, automation, and other industrial methods if they actively participate in meaningful experiences dealing with the manufacture of consumer goods, utilization and generation of energy, as well as the servicing, testing, and repairing of industrial products.

2. **Discover and develop abilities, aptitudes, and interests related to the technical pursuits and applied sciences.**

Opportunities for students to have experiences which assist in the discovery of abilities and to develop to their full potential are essential to the basic education of all youth. Allowance for differences of abilities, interests, and needs should be incorporated into the curriculum offerings so students can better assess their abilities and interests for making occupational choices, understanding the environment, and preparing to meet the changing demands of a technological society. Occupationally-oriented industrial arts programs shall be designed to: (1) assist individuals in making informed and meaningful occupational choices and, (2) prepare individuals for enrollment in advanced or highly skilled vocational and technical programs.

3. **Develop basic skills in the safe and proper use of industrial materials, tools, machines, and processes.**

Students are provided with experiences which help them develop basic skills relevant to industrial production and servicing; through these experiences, students gain a basis for making occupational choices. In addition, the skills provide a basis for a specialized occupational preparation. Many workers of the future will be required to train and retrain for different occupations during their lifetimes. Fundamental skills and knowledge in diversified areas are essential if this retraining is to be accomplished in an efficient manner.

4. **Develop problem solving and creative abilities relating to the tools, machines, materials, processes, and products of industry.**

The industrial arts educational program provides opportunities for solving various types of technical problems through experimentation and research as well as project planning and construction. The industrial arts laboratory setting provides an environment which makes possible a concrete, understandable approach to teaching problem solving and critical thinking. Problem solving in industrial arts education involves creative thinking and provides experiences which allow students to find solutions to problems and to evaluate the effectiveness of these solutions.

5. **Develop an understanding of industrial and technological career opportunities and their requirements and develop those traits which will help students obtain and maintain employment.**

Industrial arts involves the preparation, growth, and guidance of the individual student for modern living through an instructional program including the technical, consumer, occupational, recreational, organizational, social, historical, and cultural aspects of industry and technology. While industrial arts utilizes and motivates general education learning experiences, its scope and sequence of courses have a direct relationship to vocational education as well as career education concepts.

General Objectives of Plastic Education

Among the family of industrial materials, plastics are relatively new as a major manufacturing material. Development of the industry and the use of plastic materials has proceeded at an accelerated rate since the mid-1940's. At the present time, manufacturers in the United States, and throughout the world are finding it almost impossible to engage in any activity without using plastic materials in one or many forms.

The purpose of including plastic technology in the well-rounded industrial arts program is to acquaint students with the many plastic materials and processes as they are used by industry in Missouri. A student will be given the opportunity to develop a vocational interest in the plastic industry as a result of classroom experience. Job opportunities exist at all levels--machine operator, skilled crafter, technician and engineer. Knowledge of plastics may lead to management occupations of sales, marketing designing and others remotely related to the materials.

A well-rounded, broadly conceived program of plastic technology spanning the various levels of secondary education will be organized to satisfy the following objectives:

1. to stimulate students' creative abilities in design and workmanship through the use of experimentation and projects using plastics
2. to broaden the students' understanding of the physical, chemical, thermal, and electrical properties of plastic materials
3. to provide the student an opportunity to explore the various methods of (a) fabrication and (b) conversion of plastic materials by actual work experience, using the tools, materials, and products related to those in industry.
4. to provide information and practices related to good health and safety habits while working with plastics
5. to acquaint the student with the vast employment opportunities unique to the plastics industry

BEHAVIORAL OBJECTIVES FOR LEVELS I-IV

LEVEL I

Exploring Plastics Technology

Upon completion of this course of study, the student will be able to:

1. Define the term "plastic."
2. Identify the natural material necessary to produce plastic resins.
3. Name and describe the two major groups of plastics.
4. Define the term "processing method."
5. List and describe the conversion methods.
6. Describe the purpose of tooling for the plastics industry.
7. Identify and list occupational titles of the occupational tree.
8. Identify and apply safety rules when working with plastic forming equipment and plastic material.
9. Report on the economics of quantity production of plastic products.
10. Follow correct procedures while producing a dip formed product.
11. Produce a polished finish on acrylic material.
12. Correctly cut and drill plastic material.
13. Define high and low pressure lamination and produce a laminated product.
14. Chart the occupations available through and including the plastic industry.
15. Cast a product from liquid plastic materials.
16. Elaborate on the phrase "The Age of Plastics" and its meaning in today's contemporary living.
17. Perform a solvent weld joint.
18. Produce a product by the vacuum form process.
19. Produce a product by the blow forming process.
20. Silk screen labels on plastic surfaces.
21. Describe and perform the hot stamp process of plastics finishing.
22. Describe and produce a plastic part through the forming processes of:
    a) injection molding
    b) extrusion molding
    c) rotational molding
    d) blow molding
    e) compression molding

Basic Plastic Technology

Upon completion of this course of study, the student will be able to:

1. Associate the appropriate stock formulation with the corresponding converting method.
2. Associate the relative costs of liquid, powder, granules, pellets, and sheet formation.
3. Identify the sources of polymeric materials.
4. Produce a wood mold and a gypsum mold.
5. List the primary additives and their benefit to the particular resin.
6. Identify the common thermoplastic resins and give example products typically manufactured from each.
7. Exhibit good housekeeping in conducting each laboratory procedure.
8. Identify materials, tools, and procedures necessary to produce a reinforced plastic product.
9. Identify the common thermoset plastic resins and give examples of products typically manufactured from each.
10. Perform the steps of procedure to produce a vacuum form product.
11. Correctly identify the various production processes and compare with typical resin and product.
12. Perform the steps of procedure of machine setup and operation in the plastic part processes of:
    a) injection molding
    b) extrusion molding
    c) rotational molding
    d) blow molding
    e) compression molding
13. Perform the various fabrication techniques.
14. Perform exercises in hot gas welding techniques.
15. Engrave plastic such as performed by the sign and label making industry.
16. Produce an expanded plastic product utilizing the open and closed cell materials.
17. Correctly perform the processes of stamping, blanking, tapping, threading, turning, and milling of plastic stock material.
18. Understand the reasons for fillers, extenders, plasticizers, stabilizers, reinforcements, and flame retardant components.
19. Identify and perform several methods of fastening plastic parts including mechanical, chemical, and physical methods.
20. Use colorants successfully in several forming techniques.
21. Define the processes of annealing and postcuring.
22. Prepare and participate in conducting an occupational analysis of the plastic industry.
23. Conserve the natural resources of the plastics industry.

Applied Plastic Technology

Upon completion of this course of study, the student will be able to:

1. Define the technique of tooling.
2. Machine a mold.
3. Troubleshoot a common molding process.
4. Determine the quality production process.
5. Select and identify the appropriate tests of plastic properties.
6. Produce and finish a sand cast aluminum mold.
7. Produce an aluminum filled epoxy mold..
8. Assess consumer opinion regarding reliability of plastic products.
9. Produce plastic packaging processes of:
   a) blister
   b) skin cooling
10. Identify the employment potential of the plastic industry.
11. Produce a RTV mold for the production of a simulated wood and/or a simulated marble product.
12. Identify commercial considerations such as: material selections, production rates, hygroscopic properties, molding temperature control, price quotations, plant locality, and shipping requirements as they relate to the plastic industry.
13. Understand the basic principles of pneumatics and hydraulics as they relate to the plastic forming industry.
14. Satisfactorily perform a variety of physical tests on plastic materials.
15. Describe and produce an electroplated surface on plastic.
16. Define the laser cutting process.
17. Identify the machining preocesses employed in plastic fabrication.
18. Define quantity production techniques of the plastic industry.
19. Use one molding making process to make a mold for the plastic forming processes of:
    a) injection molding
    b) extrusion molding
    c) rotational molding
    d) blow molding
    e) compression molding
20. Design a mold for fiber glass reinforcement plastic technology.

Safety in Handling Plastics[3]

Every industrial arts teacher must be concerned with the students' safety in classes which have laboratory activities as part of the instructional procedures.

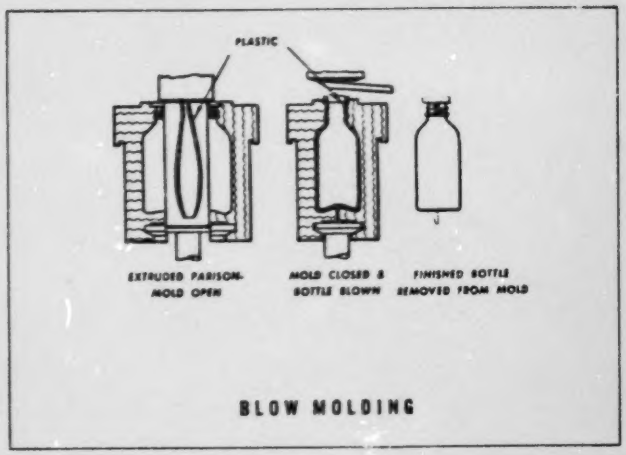
Teachers of laboratory courses typically provide an environment safe from the normal hazards of working with tools and machines, hot substances, welding rays, and chemical hazards. The industrial arts teacher has learned to provide the necessary personal protective wear for the various laboratory areas (see Missouri Eye Safety Law). The teacher of industrial plastics has particular concerns, because of the chemical nature of several laboratory activities, for the safety of each student.

Catalysts used in polymerizing many of the liquid polyesters have certain hazardous characteristics. Methyl Ethyl Ketone Peroxide (MEKP) is extremely dangerous if brought in contact with the eyes. Just one drop of this catalyst material will progressively destroy the eye tissues and result in blindness, unless it is washed from the eye immediately: within four seconds. Prevention of accidental injury should be as follows: (1) Wear chemical safety goggles and protective gloves while mixing resins. (2) Keep fresh clean water within fast reach of the work area. And, (3) Do not rub the eyes for any reason if the catalyst has been handled.

If eye contamination is suspected, wash immediately and consult a physician. For further information concerning the dangers of MEKP send for the free information AWA Safety Code:

AWA Safety Code
P. O. Box 1261
Jefferson City, MO 65101

[3]Missouri. Department of Elementary and Secondary Education. Division of Career and Adult Education. Vocational Safety Guide. University of Missouri, Columbia, Department of Practical Arts and Vocational Technical Education, 1981.



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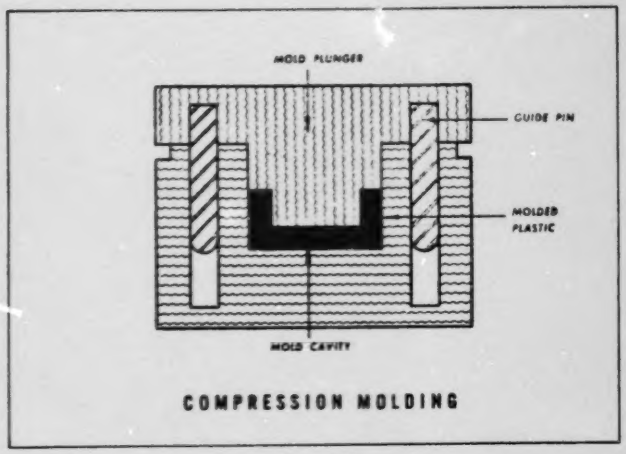

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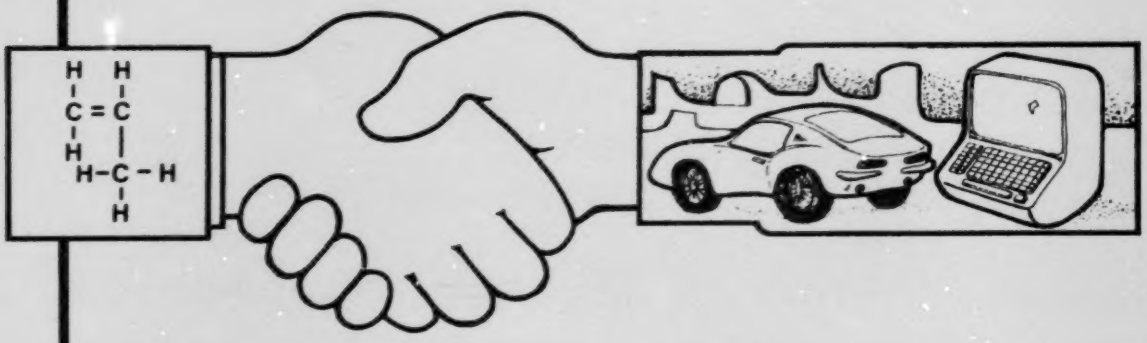
Instructional Units



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UNIT I PLASTIC INDUSTRY IN PERSPECTIVE

Level	Curriculum Interest	Teacher Activities	Student Activities
I, II	**History of Plastics**	Discussion of history that led to the development of plastics.	Define the early plastic products.
			Identify the early founders of the plastic industry.
I, II	**Origin of Plastics**	Show examples of raw materials used to make plastics.	List the different types of raw materials used in the production of plastics.
		Show a film depicting a resin plant and/or the raw materials used to make plastics.	Bring samples of plastics found in the home.
		Discussion of the molecular structure of plastics.	Identify the names of chemicals which are most common in the production of plastics.
I, II	**Environmental Concerns and the Recycling of Plastic Products**	Discussion of the positive and negative aspects of plastics in relationship to your health and safety.	List and discuss the ways in which plastics make your life safer or create a hazard to your life.
		Show examples of plastics which can be recycled.	Bring different types of recyclable plastics for the class' information.
		Explain, using the examples you brought from home, the reasons for the different types of plastics.	List three reasons why we use as many recyclable plastics as possible.
I, II, III-IV	**Project Future Use of Plastics**	Discussion of the emerging technologies in plastics.	List and discuss the possible uses for plastics in the near future.
I, II	**Occupations**	Lecture on the many occupations in the plastics industry.	List occupations in the plastics industry.
		Show a film which depicts the varied occupations in the plastics industry.	List occupations in the plastics industry which were shown in the film.
		Discuss the educational levels needed to acquire a job in the plastics field.	Identify the level of education for each of the fields of plastics.
I, II, III-IV	**Definitions and Terms**	Using the glossary, acquaint the students with the terms and definitions in this unit.	Identify the terms on the exam.
		Define "The Age of Plastics"	

UNIT II SYNTHETIC MATERIAL TECHNOLOGY

Level	Curriculum Content	Teacher Activities	Student Activities
	Definitions and Terms	Acquaint the students with terms that they will use in this unit.	Identify the terms on the exam.
I, II	**Identification of Plastics**	Discuss and show the different kinds of plastics. (App. K)	Identify the examples shown.
I, II, III, IV	**Testing of Plastics**	Discuss the need for testing and maintaining standards when producing plastics.	List three methods of testing plastics.
I, II	• **Burn Test**	Demonstrate the burn test which identifies a plastic as thermosetting or thermoplastic.	Perform the lab activity.
III, IV	• **Specific Gravity**	Discuss specific gravity of plastics which is the ratio of the weight of the plastic compared to an equal volume of water.	Explain the meaning of specific gravity.
		Demonstrate the test for specific gravity which you will assign as a lab activity. (Appendix L-1)	Perform the lab activity.
III, IV	• **Tensile Strength**	Discuss the test used to determine the force necessary to pull the plastic specimen apart, testing for tensile strength.	Define tensile strength.
		Demonstrate the procedures used in the tensile test you will assign as a lab activity. (Appendix L-3)	Perform the lab activity.
I, II, III, IV	• **Compressive Strength**	Explain the method of testing the compression force required to rupture or deform a specimen of plastic.	Define compressive strength.
		Demonstrate a compression test on a specimen of plastic. (Appendices L-2, L-8)	Perform the lab activity.
III, IV	• **Water Absorption**	Discuss reasons why different plastics absorb water at different rates.	Define water absorption.
		Demonstrate the test for water absorption using a 1/8" thick sample for a 24-hour period. (Appendix L-4)	Perform the water absorption test.

Level	Curriculum Content	Teacher Activities	Student Activities
III, IV	• **Impact Strength of Plastic**	Explain how the impact strength of plastics can be measured.	Define impact strength.
		Demonstrate how the mechanical energy is absorbed by a standard test sample during fracture by a blow from a pendulum hammer. Use the chart for comparison. (Appendix L-5)	Perform the test.
I, II, III, IV	• **Natural Color of Plastic Molding Compounds**	Explain the relationships between the polymers and what their colors are. (Appendix L-7)	Identify three polymers by their colors.
	• **Heat Resistance**	Discuss the continuous resistance to heat in degrees Fahrenheit, while in use, for plastics. (App. L-6)	Explain the term heat resistance.
II, III, IV	• **Hardness of Molding Compounds**	Discuss the hardness of different molding compounds and the comparison of their resistance to indentation.	
		Demonstrate the procedure for testing plastics for hardness, using the Rockwell hardness tester. (Appendix L-16)	Perform a hardness test on plastics.
		Review the kinds of tests used on plastics.	List and describe five plastics testing methods.

UNIT III PRODUCT DESIGN

Level	Curriculum Content	Teacher Activities	Student Activities
I, II, III-IV	**Origin of Molding**	Discuss the early development of the synthetic plastic, bakelite, and how it revolutionized the plastics industry. Bakelite was discovered and patented in 1909 by Dr. Leo Baekeland.	Study the origin of molding plastics.
		Illustrate the continuing research and development of plastic material from 1868 to the present.	Use the chart to study the history of molding plastics.
I, II, III-IV	**Mold Construction**	Explain the stages of procedure involved in making molds for plastic-stressing. The first step is the working drawing.	Sketch a working drawing of a mold for plastics.
		Discuss permanent and non-permanent molds.	Examine and compare permanent and non-permanent molds.
I, II, III-IV	• **Aluminum Molds**	Show examples of molds. Sheet aluminum mold is a good example for the school shop.	Successfully pass the test on materials.
		Show film on aluminum molds with sand castings.	Describe the sand casting process.
		Demonstrate the sand castings process and assign it as the lab activity.	Perform the lab activity.
		Use the finished aluminum castings to demonstrate the molding of plastics using the aluminum mold.	Complete the plastic mold with your aluminum mold.
I, II, III-IV	• **Cast Epoxy Molds**	Discuss the similarities between the casting of epoxy molds and cast aluminum molds.	Compare a cast aluminum with an epoxy mold.
		Demonstrate how the epoxy mold is cast directly over the mold instead of taking a pattern of it.	Perform the lab experiment using the epoxy mold.

Level	Curriculum Content	Teacher Activities	Student Activities
I, II, III-IV	• **Cast Gypsum Cement Molds (Plaster of Paris)**	Using the prepared model, demonstrate how similar the cast gypsum cement mold is to the epoxy mold.	Use the information learned on the epoxy molds to perform the lab activity dealing with a cast gypsum cement mold.
II, III, IV	• **Machine Hardwood Molds**	Discuss the use of wood to make molds.	List the woods most commonly used to make molds.
		Demonstrate the steps of procedure in making a wooden mold.	Study the steps of procedure for making a mold out of wood.
		Assign a lab activity dealing with wooden mold making.	Perform the lab activity.
I, II	• **Plastic Molds**	Acquaint the students with the different types of plastic molds.	Examine and compare the plastic molds to the other molds studied.
I, II	• **Ceramic Molds**	Show a film or discuss ceramic molds used in plastic production.	Observe and record data on ceramic molds.
I, II, III-IV	• **Silicone Molding**	Discuss the RTV (room temperature vulcanizing) silicones which are used to cast molds for plastic production.	Define RTV silicone.
		Demonstrate the casting of RTV silicones.	Observe the RTV silicone casting process.
		Assign a lab activity dealing with the production of a mold and the pouring of RTV silicone.	Perform the RTV silicone lab activity by making a mold and pouring the mold with RTV silicone.

UNIT IV FINISHING AND DECORATING OF PLASTICS

Level	Curriculum Content	Teacher Activities	Student Activities
	Finishing Plastics		
I, II	• **Smoothing and Polishing**	Discuss the finishing of plastics, using the smoothing and polishing of plastics as examples.	List smoothing or polishing operations which can be performed on plastics.
		Demonstrate the equipment available in our shop and the proper operation of these machines.	Study the plastics finishing equipment in our shop.
		Demonstrate the steps of procedure you wish the student to follow in the lab activity.	Perform the lab activity as per the demonstration on smoothing or polishing.
I, II	• **Tumbling**	Discuss reasons why industry uses the tumbling method of finishing plastics. Primarily economic.	List the reasons industry chooses to use the tumbling method to finish plastics.
		Demonstrate the tumbling of plastics in shop or with a slide or filmstrip presentation.	Study the tumbling of plastics in shop or with a slide or filmstrip presentation.
		Demonstrate the lab activity dealing with tumbling plastics.	Perform the lab activity as per the demonstration on tumbling.
I, II, III-IV	• **Electroplating of Plastics**	Discuss the electroplating process in simple terms, such as, it is a coating process, either finishing and/or decorative.	Look for and list the electroplated items found in your home.
		Show a film on the electroplating of plastics.	Study reference material on the electroplating of plastics.
		Have "show and tell" relating to electroplated items.	Bring an item (or picture from a magazine) which has been electroplated.
		Demonstrate the lab activity dealing with the electroplating of plastics.	Perform the lab activity relating to electroplating of of plastics.
I, II, III-IV	• **Vacuum Metalizing Plastics**	Explain and show samples of the vacuum metalizing process stressing that it is a thin layer of metal on the surface of an item.	Define the vacuum metalizing of plastics.

Level	Curriculum Content	Teacher Activities	Student Activities
	Decorating of Plastics		
I, II	• **Engraving of Plastics**	Describe the mechanical engraving of laminated plastic sheets. Use examples of name tags, name plates, house signs, etc.	Explain the engraving process as it relates to plastic products.
		Demonstrate use of the engraving machine and which activity the students are to do as their lab activity.	Study the engraving machine and perform the lab activity.
I, II, III-IV	• **Painting Plastics**	Describe the advantages and disadvantages of painting plastics.	List the advantages and disadvantages of painting plastics.
		Demonstrate how to paint plastics.	Observe the painting of plastic demonstration.
		Review the plastic painting process and assign the lab activity.	Complete the lab activity dealing with painting plastics.
I, II III-IV	• **Silk Screen Printing of Plastics**	Show examples of silk screen printing on plastics and explain how successful this has been in industrial applications.	Study the silk screening of plastics.
		Demonstrate the silk screen process which is used for labeling and decorating plastics products.	Observe and take notes over the material covered in the silk screening of plastics. Design own silk screen and print on plastic.
I, II	• **In-Mold Decorating**	Describe the in-mold decorating process using Melamine dinnerware as an example of this process.	Look around your home and list items which have been decorated with the in-mold decorating process.
I, II	• **Hot Stamping**	Discuss the marking and decorating of plastics by the hot stamping process.	Define the hot stamping process.
		Show a film on hot stamping. Use a film which shows the metal die used in this process.	Write a paragraph on the film relating to the hot stamping process.

Level	Curriculum Content	Teaching Activities	Student Activities
I, II, III-IV	**Mechanical Fasteners**	Discuss the many types of fasteners used to fasten plastic to another plastic and/or plastic to another material.	Research plastic fasteners and report, orally, to the class.
I, II	• **Hot Staking**	Explain the heat staking process and how this is used as a plastic fastener.	Read the section on the hot staking process.
I, II	• **Heat Sealing**	Discuss the major heat sealing processes and show examples.	List the different types of heat sealing.
I, II, III-IV	• **Snap-Fit Mechanical Fastening**	Discuss the variety of fasteners used in the plastics industry, stressing the two classifications; external and internal (snap-fit) fasteners.	Look around your home and list items according to their classification; external or snap-fit.
		Explain how the flexible properties of plastics enable industry to snap-fit plastic materials together.	Study the plastics research materials on fasteners.
III-IV	• **Molded Threads**	Illustrate how the threading of plastic parts eliminates the need for any external fasteners.	List five applications from the demonstrations which were threaded plastics.
III-IV	• **Metal and Plastic Spring Clips**	Show examples of metal and plastic spring clips and demonstrate how they are used for fastening plastics.	Observe the use of the plastic and metal clips to fasten plastics.
I, II	• **Riveting Plastics**	Demonstrate the riveting of a plastic sheet onto a wooden frame.	Practice riveting sheet plastic material on shop project.
I, II, III-IV	**Colorants**	Discuss and show the different types of colorants used in the plastic industry.	Identify types of colorants used in the plastic industry.
		Explain the need for the mixing of colorants to achieve a specific hue.	Draw a color wheel with the primary and secondary triangle.
III-IV	**Annealing and Postcuring**	Show a film on the prolonged heating of plastic to reduce the internal stresses.	Define annealing and postcuring.

UNIT V PLASTIC CONVERTERS (FORMING TECHNIQUE I)

Level	Curriculum Content	Teacher Activities	Student Activities
I, II	**Industrial Processes**	Discuss industrial processes and how they are related to everyday life.	List five common items in the home which have been manufactured.
I, II	**• Injection Molding**	Lecture on injection molding with emphasis on the fact that this process is the one most often used in forming thermoplastic.	Name the material which is used for injection molding.
		Discuss the steps involved in injection molding.	List the steps necessary in the injection molding process.
		Demonstrate the lab activity you have assigned to the students. An example of injection molding could be golf tees, etc.	Set up and operate injection molder. Perform the lab activity which relates to the injection molding process.
I, II	**• Extrusion**	Explain the extrusion process.	Define the extrusion process.
		Discuss the different types of extrusion forming.	List three types of extruded plastics.
		Show a film and/or examples of different types of extrusion forming.	Bring examples of extruded plastic products from the home.
		Demonstrate the lab activity which you have assigned to the students.	Set up and operate extruder. Perform the lab activity.
I, II	**• Blow Molding**	Discuss the blow molding process.	Describe the blow molding process.
		Show student examples of blow formed plastics.	Bring an example of blow formed plastic to share with the class.
		Demonstrate the activity you assigned to the students as a lab activity; such as, a barrel bank or water bottle to fit on a bicycle.	Set up and operate blow molder. Perform the lab activity.
I, II	**• Compression and Transfer Molding**	Discuss the compression and transfer molding process.	Define compression and transfer molding.
		Discuss the difference in compression and transfer molding.	Explain the difference between the compression and transfer molding process.
		Demonstrate the lab activity which familiarizes the student with compression molding, such as a key chain.	Set up and operate compression molder. Perform the lab activity.

Level	Curriculum Content	Teacher Activities	Student Activities
I, II	• **Slush Molding**	Introduce the slush molding process with diagrams and or examples.	Identify five items which were produced by the slush molding process.
I, II	• **Dip Molding**	Explain the dip molding process for the assigned lab activity, such as a coin purse.	Properly perform the lab activity.
III-IV	• **Powder Molding** • **Powder Coating** • **Rotational Molding**	Discuss the processes involving the use of dry plastics powders.	List the processes which involve the use of dry plastics.
		Show a film or discuss rotational molding, stressing its versatility of design.	Describe the rotational molding process.
		Explain the rotational molding process and its basic steps of procedures.	List the basic steps in the rotational molding process.
			Set up and operate rotational molder.
		Describe static molding and spray coating.	Perform lab activity.
		Demonstrate the fluidized bed coating process and incorporate this process in the lab activity.	Define static molding and spray coating processes.
			Set up and operate fluidized equipment.
			Perform the lab activity.
III-IV	**Fillers and Extenders**	Discuss materials used as fillers and extenders.	
		Discuss the economics of using fillers and extenders.	
		Demonstrate physical property changes as a result of various percentages of fillers and extenders. (Appendix L-11)	Perform lab activity by testing material strengths: compression, tensile, etc by varying percentages of fillers and extenders.
III-IV	**Additives**	Discuss reasons for the use of additives.	

UNIT VI PLASTIC FABRICATION (FORMING TECHNIQUE II)

Level	Curriculum Content	Teacher Activities	Student Activities
I, II	**Industrial Processes**	Discuss industrial processes as a whole.	List five industrial processes.
I, II, III-IV	• **Expanded Plastics**	Lecture on the advances in foamed plastic molding.	Define expanded (foam) plastic.
		Discuss the mechanical, physical, and chemical foaming of plastics.	List the three principal methods of producing foamed plastics.
		Explain and show examples of expandable bead molding.	Define expanded bead molding.
		Demonstrate the lab activity you wish the students to perform using the expanded plastics methods. (App. L-15)	Perform the lab activity.
I, II, III-IV	• **Assembly of Plastic Parts**	Lecture on the problems involved with the fastening of plastics with emphasis on the two groups of bonding: cohesion and adhesion.	Name the two groups of bonding plastics.
		Demonstrate the bonding of plastic pipe with a solvent cement. (App. L-12)	Bond two pieces of plastic together.
II, III-IV	• **Welding of Plastic**	Introduce welding of plastics, emphasizing fusion, friction, hot gas, and ultrasonic welding techniques.	List the processes used to weld plastics.
		Show a film which shows the differences in the aforementioned welding processes.	Observe and take notes on the film on welding of plastics.
II, III-IV	• **Fusion Welding**	Discuss fusion welding, emphasizing that this is a mechanical process involving the use of a hot plate or heated tool to soften plastic to the molten stage, whereby the two molten parts can be joined together.	Define fusion welding.
		Demonstrate the fusion welding technique which the students will cover in the lab as part of their plastic project.	Observe the demonstration; this will be your lab assignment.
		Review the fusion welding steps of procedure and assign the lab activity.	Perform the lab activity.

Level	Curriculum Content	Teacher Activities	Student Activities
I, II, III-IV	• **Friction Welding**	Introduce friction welding, which is the welding of thermoplastics by rotation (also called spin welding).	Explain friction welding of plastics.
		Demonstrate the friction welding technique either on the lathe or drill press (use special chuck or holding device).	Observe the demonstrations of friction welding.
		If you want the student to perform a friction weld, assign a lab activity.	If lab activity is given for the friction welding of plastics, perform this assignment.
II, III-IV	• **Hot Gas Welding**	Introduce hot gas welding, stressing its versatility in the construction of parts which are difficult to mold.	Study hot gas welding in the text.
		Elaborate on hot gas welding discussing which resins are best adapted to this process.	List the resins which are best suited to the hot gas welding process.
		Discuss the gases commonly used to hot gas weld plastics.	List the gas commonly used to hot gas weld plastics.
		If you have the equipment available, extrude your own filler rods of the material that is to be hot gas welded.	Observe and participate in making filler rods to be used in the lab activity on hot gas welding of plastics.
		Demonstrate the hot gas welding technique.	Observe the hot gas welding technique.
		Assign the lab activity dealing with hot gas welding.	Perform the lab activity.
III-IV	• **Ultrasonic Welding**	Introduce ultrasonic welding of plastics.	Define ultrasonic welding of plastics.
		Show the students the horns used in ultrasonic welding and explain why the size and shape of the plastic part to be joined determines the size and shape of the horn.	Define "horn" as it relates to ultrasonic welding.
		Demonstrate the ultrasonic welding process, if you have the equipment. If you do not have the equipment, show the steps of procedure either with slides or transparencies.	Observe the steps of procedure involved in the ultrasonic welding of plastic.
		Assign a lab activity. Substitute a paper for the lab activity if you do not have the necessary equipment.	Satisfactorily perform the assignment.

Level	Curriculum Content	Teacher Activities	Student Activities
I, II, III-IV	• **Heat Sealing Plastics**	Discuss the theory of heat sealing and show how it involves the combining of two or more thicknesses of thermoplastic film or sheets by melting them together.	Define heat sealing.
		Demonstrate the heat sealing method by using a bar type sealer (can use the home variety of a Seal-A-Meal).	Perform the lab activity by heat sealing an object.
		Discuss the other heat sealing techniques, such as impulse, ultrasonic, and dielectric heat sealing.	Name heat sealing processes and describe them.
I, II, III-IV	• **Calendering**	Describe the process of calendering, emphasizing that this is generally done with flexible polyvinyl chloride material.	Name the material most often used in the calendering process.
		Explain, by using a schematic or film, the main steps in the calendering process.	List the steps in the calendering process.
		Discuss how the calenders are sometimes used to coat other materials.	Name another use for the manufactured calenders.
I, II, III-IV	• **Laminating Plastics**	Discuss the laminating process and how the material is bonded together with two or more layers of materials to form a single layer.	Define the laminating process, pictorially.
		Show a film on the laminating process.	Draw a chart showing the laminating process.
		Discuss the different materials used in the laminating process.	List five materials which can be used in the laminating process.
		Describe the compreg laminating process whereby layers of dissimilar materials are impregnated with a thermosetting resin and cured under heat and pressure.	Define compreg laminating.
		Demonstrate the lab activity you wish the students to perform.	Perform the lab activity.

Level	Curriculum Content	Teacher Activities	Student Activities
I, II, III-IV	• **Reinforced Molding**	Discuss reinforced molding emphasizing the definition: A product formed by using a plastic resin and a reinforcing material.	Study the information in the text which covers reinforced molding of plastics.
		Explain the advantages of using thermosetting resins in the reinforced molding process. Stress safety measures which must be taken when working with polyester resin catalysts.	List the advantages of using thermosetting resins in the reinforced molding process.
			Follow safety rules at all times. Most Important to Remember: **Wear Your Safety Glasses!**
		Discuss the different reinforcing materials, stressing the fact that this is only one of the materials used to reinforce plastics.	Write a report on the types of materials used in reinforced plastics production.
		Discuss the two main molding methods - closed mold processing and open molding and how they are used in reinforced plastic production.	Study the two main molding methods used in the reinforced molding of plastics.
		Show a film on the machine used for molding reinforced plastics.	Observe and write a one-page paper on the film about reinforced plastics.
		Define "lay up."	Define "lay up."
		Explain the steps of procedure necessary to do the spray lay-up procedure.	Study spray lay-up materials in text.
		Demonstrate the steps of procedure involved in the hand lay-up process.	Observe the hand lay-up demonstration (this is your lab activity).
		Assign the project which is to teach the molding of plastics by the reinforcing method.	Perform the lab assignment.
I, II, III-IV	• **Thermoplastic Sheet Material**	Discuss the thermoforming of plastic sheet goods while emphasizing that this is the oldest plastic forming technique in industry.	Define thermoforming of plastic sheet goods.
		Show a film on the different thermoplastic forming techniques.	List the different processes which use thermoforming plastic sheet goods.

Level	Curriculum Content	Teacher Activities	Student Activities
II, III-IV	• **Matched Molding**	Lecture on the matched molding technique of forming plastics.	Define the matched mold process.
		Show a film on the matched mold process of forming plastics.	Draw a diagram which shows the parts of molds as they are used in matched molding.
		Explain the steps of procedure involved in the matched mold process.	List the steps of procedure for the matched molding process.
		Demonstrate the lab activity which the students are to perform in the lab.	Perform the lab activity.
I, II, III-IV	• **Vacuum Forming**	Describe the vacuum forming technique with emphasis on the fact that this is the most versitile and least expensive of the plastic forming techniques.	Define the vacuum forming process.
		Discuss the machinery needed to produce vacuum formed plastics.	List the machines needed in the production of vacuum formed plastics.
		Discuss the variations of vacuum forming of plastics.	List the different applications of vacuum forming plastics.
		Describe the mechanical plug assist method of thinning material in deep mold cavities. Expand; plug assist, etc.	Study the plug assist vacuum forming technique.
		Demonstrate the lab activity.	Perform the lab activity.
III-IV	• **Pressure Forming**	Discuss the pressure forming process which is sometimes called air blowing. DO NOT CONFUSE THIS PROCESS WITH BLOW MOLDING.	Study the pressure forming of plastics.
		Use a film to show the pressure forming technique used on thermoplastics.	Complete a report on the film.
I, II	• **Straight Pressure Forming**	Define straight pressure forming which involves a female mold over which a sheet of thermoplastic material is clamped.	Study the forming process.
		Use a wooden mold that you made to illustrate the forming of thermoplastic sheet material by the straight pressure method.	Observe the demonstration on the straight pressure forming technique.
		Demonstrate the lab activity you wish the students to do on straight pressure forming.	Perform the lab activity.

Level	Curriculum Content	Teacher Activities	Student Activities
I, II, III-IV	• **Free Blowing**	Define free blowing, being careful to differentiate between free blowing and blow molding. These techniques are sometimes confused.	Study the free blowing process.
		Illustrate how a heated sheet of plastic can be formed with additional heat and pressure. Explain how this process is similar to the expansion of our lungs - or like a balloon.	Perform the lab activity.
		Show a film or slides depicting examples of free blowing - skylights, large signs, etc.	List five items we commonly see which are produced by the free blowing method.
I, II III-IV	**Machining of Plastics**	Lecture on the many ways in which plastics can be machined. (App. L-10)	List the most common methods of machining plastics.
I, II, III-IV	• **Cutting of Plastics**	Discuss and demonstrate how to cut plastics with the equipment in your lab. Show film on any other process which you lack the facilities to do in your lab.	List five ways to cut plastics.
		Demonstrate the procedures you wish the students to perform in the lab.	Perform the lab activity.
		Explain the importance of using the charts in the lab for reference when cutting plastics. (App. L-9, L-14)	List why charts are an important part of a lab activity.
I, II	• **Drilling of Plastics**	Discuss the drilling of plastics with emphasis on the different types of drills available to produce best results.	
		Explain the drill speed and point angle chart for the drilling of plastics. (L-13)	
		Demonstrate the procedures you wish to follow in the lab assignment.	Perform the lab activity.
I, II	• **Filing**	Discuss the different types of files which can be used to shape plastics.	List three files to be used for filing plastics.

Level	Curriculum Content	Teacher Activities	Student Activities
II, III-IV	• **Tapping and Threading of Plastics**	Explain the tapping and threading procedure with emphasis on the use of lubricants for the working of plastics.	Describe the tapping and threading of plastics.
		Demonstrate the procedures you wish to follow in the lab assignment.	Perform the lab activity.
II, III-IV	• **Turning, Milling, Planing, Shaping, and Routing**	Discuss the types of cutters used to machine plastics.	List the cutters used most often to cut plastics.
		Discuss the rake and clearance angles of cutting tools.	Draw a general purpose cutting tool for plastic and designate angles necessary to cut plastic materials.
		Explain the formula used to determine the amount of feed per minute.	Solve a problem dealing with feeds.
		Demonstrate the procedures you wish to follow in the lab assignment.	Perform the lab activity.
III-IV	• **Laser Cutting**	Familiarize students with laser cutting. (Also inform students about laser inspection.)	Explain how the laser cutting method is used on plastics.
	Mechanical Fasteners		
I, II	• **Stapling Plastics**	Make a model and demonstrate the stapling of plastics.	Use the model to practice stapling plastic.
I, II	• **Plastic Hinges**	Discuss how polyallomer strips can be shaped to form a plastic hinge.	Study the procedures used in the making of a plastic hinge.
		Demonstrate the steps of procedure to follow to make a plastic hinge. Have students incorporate the plastic hinge in their project for this unit.	Perform the lab activity.

UNIT VII QUANTITY PRODUCTION PROCESSES

Level	Curriculum Content	Teacher Activities	Student Activities
I, II, III-IV	**High Production Processes**	Give an overview of quantity production in the plastic industry.	Study the quantity production section in the text.
		Refer to Units V and VI to insure adequate coverage of all of the industrial processes.	
		To give the students a better understanding of the term "quantity production," show a film and/or use visual aids to explain multiple cavities of molds. Explain how this increases productivity in the plastics industry.	Define "quantity production" as it relates to the plastic industry.
		Discuss cost effectiveness of high production as it relates to the production of plastics.	Write a report explaining the economic reasoning behind the production of plastic products in large quantities.

UNIT VIII MANPOWER AND THE PLASTICS INDUSTRY

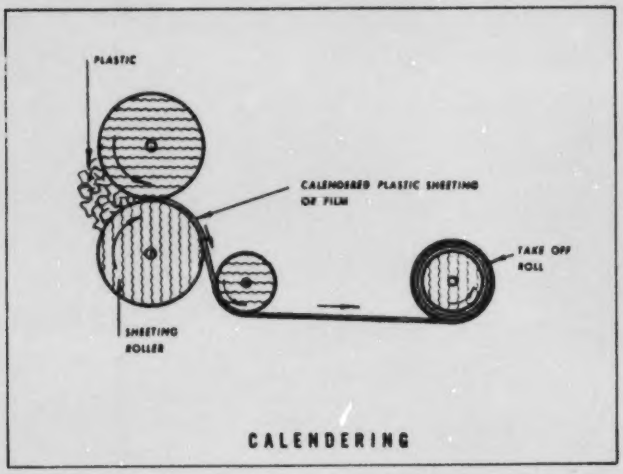
Level	Curriculum Content	Teacher Activities	Student Activities
I, II, III-IV	**Occupations**	Discuss the wide range of occupational opportunity available to the students in the plastics industry; these include: A) Machine operation B) Set-up person C) Mold maker D) Technician E) Engineer F) other Add the data that 78% of all plastics companies surveyed indicated a preference for high school graduates with plastics training.	Make a chart showing the occupations which are available in the plastics industry.
I, II	**Occupational Analysis**	Discuss the steps of procedure involved in researching an occupational area. Divide the class into groups, with each person having a copy of the occupational analysis sheet and the career patterns diagram. (Appendix O) Note to the Teacher: If you do not have an occupational analysis sheet at your disposal, it would be advisable to have the class, as a whole, develop this document including such information as: A) Educational level needed by the employee in the plastics industry. B) Previous experience required. C) Classification of occupation: 1. Professional/clinical 2. Supervisory 3. Technical 4. Skilled 5. Semi-skilled D) Others	Take notes on the research procedure. Help prepare and/or obtain your occupational analysis sheet and meet with your assigned groups. Be sure you you also have a copy of the career diagram.

Level	Curriculum Content	Teacher Activities	Student Activities
		Make sure the proper references are available either in the library or in the classroom.	Start your occupational analysis research using the following references: A) Dictionary of Occupational Titles. B) Encyclopedia of Job Description in Manufacturing, and C) Bureau of Labor Statistics.
		Determine at regular intervals that the groups are progressing satisfactorily. Review if the need arises.	Whenever a problem arises, be sure to ask the teacher for clarification-DO NOT GET BOGGED DOWN.
		Announce an order in which the groups will present their findings.	Review your group's findings and prepare your presentation. Each person needs to participate in the presentation.
		Introduce the groups and evaluate their presentations by noting if all catagories in the occupational analysis sheet have been covered satisfactorily.	As a group, give your presentation covering all of the areas on your occupational analysis sheet.
		Compare the different occupations available in the plastic industry. A) Educational level B) Previous experience if necessary. C) Classification of occupations D) Others	Take notes on the occupational comparisons.

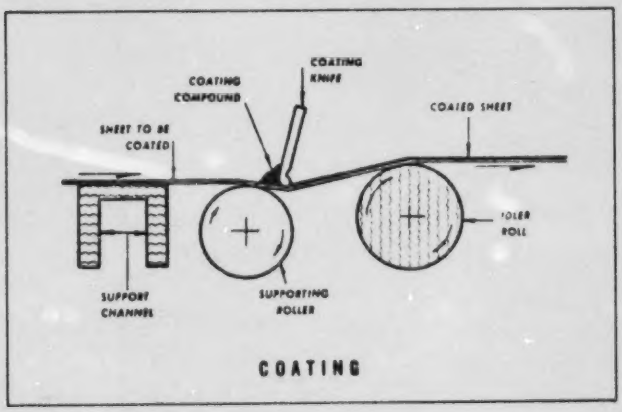
UNIT IX PLASTIC INDUSTRY IN PERSPECTIVE, REVISITED

Level	Curriculum Content	Teacher Activities	Student Activities
I, II	**Review**	Summarize the past and present status of the plastics industry. This could be brief or in-depth as your time permits. Refer to Units I-VIII as necessary to tell the "Big Picture."	Outline the past and present status of the plastics industry.
I, II	**The Future of the Plastics Industry**	Illustrate the future of plastics emphasizing that it has been predicted that in the year 2000 the plastics industry will be using approximately 200 billion pounds of plastic materials. This is a huge increase from the 1977 usage of 33 billion pounds.	Compare the usage of plastic in pounds from 1977 to the year 2000. What percentage of increase do you find?
I, II	• **Construction Industries**	Discuss the expanding use of plastics in the construction field.	List ways in which plastics can replace conventional material in the construction field.
I, II	• **Automobile Industries**	Use plastic parts of an automobile to illustrate the fact that in the future we may have cars with 60% of their weight in plastics. Stress the economics of this trend.	Name plastic parts found on today's cars and compare them to parts which you feel could be produced using plastics.
I, II	• **Conservation of Natural Resources**	Stress the conservation of natural resources when we replace conventional material with plastics.	Study what is being done to conserve our natural resources by replacing the use of some of these with a plastic material.
I, II	• **Surgical/Medical Industries**	Acquaint the students with the advances in the surgical medical fields (transplants, etc.).	Study the local newspaper to see if there are any articles on medical breakthroughs using plastic transplants.
I, II	• **Aerospace Industries**	Discuss the aerospace industry and how large amounts of plastics are used.	List the advantages of using plastics in the aerospace industry.

Level	Curriculum Content	Teacher Activities	Student Activities
I, II	• **Electronics-Communications Industries**	Discuss the electronics and communication industries. Encourage the students to recall any information they have on these two industries by having a discussion period after you have given the initial lecture.	Study the material in the text which relates to the electronics and communication industries.
		Be the moderator in the class discussion on the electronics and communication industries.	Participate in the class discussion on the electronics and communication industries. Don't forget television and telephone - two forms of electronic communication we use everyday.
I, II	• **New Consumer Products**	Discuss how the new plastic products of the future will be the direct result of continuing research in the plastics industry.	Think of an object which is now made of a conventional material but could be made of plastic in the future.
		Have the students draw an object which is currently being made of some other material besides plastic. Have the students re-design the object using plastic material and processes.	Perform the assignment using your imagination to its fullest.

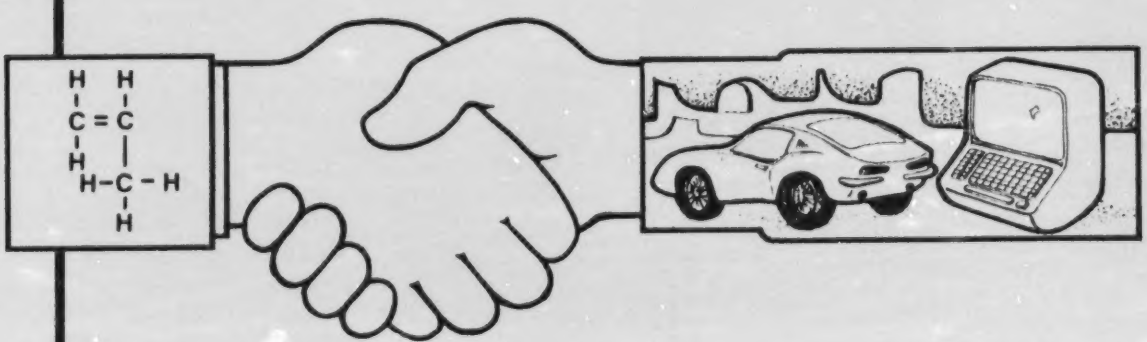


CALENDERING



COATING

Plastics Bibliography



BEST COPY AVAILABLE

Ahmend, Mukhtar, Coloring of Plastics: Theory & Practice, 1979, text ed. 1995, (ISBN 0-442-20267-9), Van Nos Reinhold.

Albright, Lyle R., Processes for Major Addition-Type Plastics, & Their Monomers, 396p., 1981, Repr. of 1974, ed. lib., bdg., write for info. (ISBN 0-89874-074-6), Krieger.

American Society of Civil Engineers, Compiled by, Selected Abstracts on Structural Applications of Plastics, (Manual & Report on Engineering Practices Ser: No. 47), 80p., 1967, pap. text ed. 4.00, (ISBN 0-87262-221-5), Am Soc. Civil Eng.

_____, Annual Book of ASTM Standards, 1981, Plastic Pipe & Building Products, Pt. 34, 1014 p. 1981, 42.00, (ISBN 0-686-76002-6, 01-034081019), ASTM.

Baird, Ronald J., Industrial Plastics, LC 81-13514, (Illus.), 320p., 1982, 13.20, (ISBN 0-87006-402-9), Goodhart.*

Bajel, Mahendra D., ed. Plastic Polymers Science & Technology, LC 81-13066, (Society of Plastic Engineers Monographs), 992p., 1982, 150.00x, (ISBN 0-471-04044-4, Pub. by Wiley-Interscience), Wiley.

Baker, John & Heyman, J, Plastic Design of Frames, 2 vols., Incl., Vol. 1, Fundamentals, 32.95, (ISBN 0-521-07517-3), pap. 15.95, (ISBN 0-521-29778-8), Vol. 2, Applications, 40.75, (ISBN 0-521-07984-5), LC 69-19370, (Illus.), 1969-1971, Cambridge U. Pr.

Bakker, Marilyn, Rim: Breakthrough Ahead?, P-054, 1980, Set 850.00, (ISBN 0-89336-202-6), BCC.

_____, Plastics Planning Guide: 1979-80, 1980, 85.00, (ISBN 0-89336-248-4), BCC.

_____, Plastics Powders, P-046, Rotational, Coatings, (Illus.), 1977, 525.00, (ISBN 0-89336-099-6), BCC.

Beck, Ronald D., Plastic Product Design 2nd ed., 424p., 1980, text ed., 28.50, (ISBN 0-442-20632-1), Van Nos Reinhart.

Benjamin, B.S., Structural Design with Plastics, 2nd ed., 416p., 1981, text ed. 32.00, (ISBN 0-442-20167-2), Van Nos Reinhold.

Benjamin, William P. Plastic Tooling Techniques & Applications, LC 75-39845. (Illus.), 256p., 1972, 32.50, (ISBN 0-07-004554-2, P&RB), McGraw.

Berry, N., Plastic Parts Designers Handbook, Date not set, Price not set, (ISBN 0-442-24421-5), Van Nos Reinhold.

Bloch, Bernard & Hastings, Garth W., Plastics Materials in Surgery, 2nd ed. (Illus.), 284p. 1972, 24.00x, (ISBN 0-398-02365-0), C C Thomas.

Burlace, C.J., & Whailey, L., Waste Plastics & Their Potential for Recycle, 1977, 1981, 40.00x, (ISBN 0-686-97166-3, Pub. by W. Spring England), State Mutual Bk.

_____, The Plastics Closure Market: P-062, 1982, 1500.00, (ISBN 0-89336-291-3), BCC.

Butters, Gordon, ed, Plastics Pneumatic Conveying & Bulk Storage, (Illus.) xii, 295p., 1981, 59.95x, (ISBN 0-68032130-8), Intl. Ideas.

_____ Plastics Pneumatic Conveying & Bulk Storage, (Illus.), 107p., 1981, text ed. 54.00, (ISBN 0-686-37006-6, Pub. by Applied Sci, England), J.K. Burgress.

Buttrey, D.N., ed. Plastics in Furniture, (Illus.), 1975, 29.95, (ISBN 0-85334-647-X), Intl. Ideas.

Cherry, Raymond, General Plastics Projects & Procedures, rev. ed., (Illus.), (gr. 10-12), 1967, text ed. 15.32, (ISBN 0-87345-162-7), McKnight.*

Clarke, Peter J., Plastics for Schools, Applied Polymer Science, 191p. (gr. 9 up), 1973, pap. 9.95, (ISBN 0-263-05380-6), Transatlantic.

Cook, J. Gordon, Your Guide to Plastics, 320p., 1968, 40.00x, (ISBN 0-900541-52-0, Pub. by Meadowfield Pr. England), State Mutual Bk.

Cope, Dwight W. & Schoude, Lee E. Plastics, LC 73-21618, (Illus.), 112p., 1977, text ed. 5.20, (ISBN 0-87006-239-5), Goodheart.*

Crawford, R.J., Plastics Engineering, (Illus.), 160p., Date not set 75.00, (ISBN 0-0802626207), pap 25.00, (ISBN 0-08026263-5), Pergamon.

Design & Manufacture of Plastic Injection Moulds, (Productivity Ser: No. 13), 70p., 1979, pap. 8.25, (ISBN 92-833-1703-3, APO 93, APO), Unipub.

Dietz, Albert G., Plastics for Architects & Builders, 1970, text ed. 15.00x, (ISBN 0-262-5400-6), MIT Pr.

Din Standards for Testing of Materials for Natural Rubber & Elastomers, 322.00, (ISBN 0-686-28185-3, 10704-5/47), Heyden.

Din Standards for Plastics, Moulding Materials, 396.00, (ISBN 0-01-0056521, 10056-5/21) Heyden.

Din Standards, Pipes, Pipeline Components & Pipe Joints, 239.00, (ISBN 0-686-28187-X, 10790-4/52), Heyden.

Din Standards, Plastics Half-Finished Products & Finished Projects, 390.00, (ISBN 0-01-078925-1, 10705-5/48), Heyden.

Din Standards, Plastics-Test Standards for Mechanical Thermal & Electrical Properties, 393.00, (ISBN 0-686-28169-1, 10053-4/18), Heyden.

Din Standards: Plastics Two: Test Standards for Chemical & Optical Properties-Usabiltiy & Processing, 547.00, (ISBN 0-686-28186-1, 10705-5/48), Heyden.

Disposal of Plastics with Minimum Environmental Impact, 1973, 4.25, (ISBN 0-8031-0083-3, STP533), ASTM.

Domino, Francis A., Plating of Plastics: Recent Developments, LC 79-15918, (Chemical Technology Review Set, No. 138), (Illus.), 1980, 39.00, (ISBN 0-8155-0770-4), Noyes.

Dym, Joseph B., Product Design with Plastics: A Practical Manual, (illus.), 288p., 1982, 27.95, (ISBN 0-8311-1141-0), Indus Pr.

Edwards, Lauton, Industrial Arts Plastics, rev. ed.(gr. 10-12), 1974, 14.65, (ISBN 0-87002-146-X, Bennett IL.*

Fantasies in Plastic, 1976, pap. 1.50, (ISBN 0-8277-5731-X), British Bk. Ctr.

Fillers & Extenders for Plastics: P-031r, 1980, 750.00, (ISBN 0-89336-290-5) BCC.

Frisch, K.C. & Saunders, J.H., eds., Plastic Foams, Pt.2., (Monographs on Plastics, Vol. 1), 592p., 1973, 98.75, (ISBN 0-8247-1219-6), Dekker.

Harper, Charles A., Handbook of Plastics & Elastomers, 950p., 1975, 46.50, (ISBN 0-07-026681-6), McGraw.

Heller, Beatrice, Cooking Crystal Craft, 160p., 1975, 12.50, (ISBN 0-8019-6181-5), pap. 6.95, (ISBN 0-8019-6182-3), Chilton.

Hess, Harry L., Plastics Laboratory Procedures, LC 78-26948, 1980, pap. 15.50, (ISBN 0-672-97138-0) pap 3.33 answer key (ISBN 0-672-97268-9), Bobbs.

Hilyard N.C., Mechanic of Cellular Plastics, 1981, text ed. 58.00x, (ISBN 0-02-949390-0), MacMillan.

Hollaway, L., Glass Reinforced Plastics in Construction: Engineering Aspects, 228p., 1978, 44.95, (ISBN 0-470-99338), Halsted Pr.

Horn, Mary, Children & Plastic Stages 1 & 2 & Background, LC 77-83010, (Science 5-13 Ser.), 1977, pap. text ed. 12.85, (ISBN 0-356-04352-5), Raintree Child.

Horne, M.R. & Morris L.J., Plastic Design of Low-Rise Frames, (Structural Mechanic Ser.), (Illus.), 256p., 1982, 45.00, (ISBN 0-262-08123-7), MIT Pr.

Injection Molding Technology, 200p. 1981, 52.00, (ISBN 0-9961072-2-3), Heyden.

Injection Molds, 200p., 1980, 46.00, (ISBN 0-9961072-0-7), Heyden.

Jambro, D., Manufacturing Processes: Plastics, 1976, pap. text ed. 6.93, (ISBN 0-13-555623-6), P.H.

Katz, Sylvia, Plastics: Design & Materials, (Illus.), 1979, 42.50, (ISBN 0-289-70783-8, Pub. by Studio Vista Bks. England), Eastview.

Kronenthal, Richard L. et al, eds, Polymers in Medicine & Surgery, LC 75-33684, (Polymer Science & Technology Ser.: Vol. 8), 330p., 1975, 37.50, 37.50x, (ISBN 0-306-36408-5, Plenum Pr.), Plenum Pub.

Laplante, Jerry C., Plastic Furniture for the Home Craftsman, LC 77-87474, (Illus.), 1978, pap. 5.95, (ISBN 0-8069-8566-6), Sterling.

Lappin, Alvin R., Plastics: Projects & Techniques, (gr 9 up), 1965, text ed. 14.00, (ISBN 0-87345-159-7) McKnight.

Levy, Sidney, Plastics Extrusion Technology Handbook, LC 81-6587, (Illus.), 300p., 1981, 29.50, (ISBN 0-8311-1095-3), Indus. Pr.

Mayofis, T.M., Plastics Insulating Materials: Chemistry Properties & Applications, 230p., 1967, 12.50, (ISBN 0-442-05197-2, Pub. by Van Nos Reinhold), Krieger.

McGregor, Ian A., Fundamental Techniques of Plastic Surgery, 7th ed., (Illus.), 324p., 1980, pap. text ed. 23.50, (ISBN 0-443-01828-6), Churchill.

McKnight, Staff Members & Miller, Wilbur R., Plastics, LC 78-53391, (Basic Industrial Arts Ser) (Illus.), 1978, 6.64, (ISBN 0-87345-796-X) softbound 4.67, (ISBN 0-87345-788-9), McKnight.*

Meltzer, Y.L. Foamed Plastics-Recent Developments. LC 76-24146. (Chemical Technology Review: No.80), (Illus.), 1977, 39.00, (ISBN 0-8155-0642-2), Noyes.

Milby, Robert V., Plastics Technology, (Illus.), 576p., 1973, text ed. 22,95x, (ISBN 0-07-041919-1), McGraw.*

Miller Plastics Products Design Handbook, Part A. (Mechanical Engineering Set, Vol. 10), 624p., 1981, 69.00, (ISBN 0-8247-1339-7), Dekker.

Millett R., Design & Technology Plastics, 1982, 20.00x (ISBN 0-08-020553-4, Pub. by A. Wheaton), State Mutual Bk.

Moody & Thomas, Chromatographic Separation with Foamed Plastics & Rubbers, (Chromatographic Science Set), 176p., 1982, 29.75, (ISBN 0-8247-1549-7), Dekker.

Muller, G. & Jarret, G.D., Plating on Plastics, 206p., 1981, 49.00x, (ISBN 0-85218-038-1, Pub. by Portcullio Pr.), State Mutual Bk.

Newman, Thelma R., Crafting with Plastics, (Chilton's Creative Craft Ser.), (illus.), 208p., 1975, 13.95, (ISBN 0-8019-5936-5), pap, 6.95, (ISBN 0-8019-6059-2), Chilton.

Newman, Thelma R., Plastics As an Art Form, rev. ed., LC 76-91122, (Illus.), 1969, pap., 8.95, (ISBN 0-8019-6563-2), Watson-Guptill. *

Newman, Thelma R., Plastics as Design Form, LC 70-169585, 1972, 12.95, (ISBN 0-8019-5595-5), Chilton.

Patterns of Use of Selected Plastics Materials other than Elastomers, pap 7.00, (ISBN 0-686-94441-0, 75.iiE.13, UN), Umipub.

Pinner, S.H., ed. Modern Packaging Films, LC 67-26705, 249p., 1967, 32.50, 32.50x, (ISBN 0-306-30632-8, Plenum Pr.,), Plenum Pr.

Plastic Film Markets, 1981, 900.00 (ISBN 0-686-33276-8, T61), Predicasts Inc.

Plastic Foams to Nineteen Ninety-Five, 1980, 900.00, (ISBN 0-686-33279-2, T58), Predicasts, Inc.

Plastic in Automobiles: O.F.M. & Aftermarket, 1980, 900.00, (ISBN 0-686-33210-5, T59), Predicasts Inc.

Plastics and Plastic Products, LC 75-39854, (illus.) 126p. 1975, pap 5.50, (ISBN 0-87765-064-0, SPP-35), Natl Fire Prot.

Plastics Film, P-33r, Supply & Demand rev. ed. 1978, 700.00 (ISBN 0-89336-135-6), BCC.

Plastics in Construction, 1979, 900.00, (ISBN 0-686-33281-4,T55), Predicasts Inc.

Plastics in Distribution Packaging, P-030r (Plastics Studies), 1977, 650.00, (ISBN 0-89336-044-9), BCC.

Rationalizing in the Injection Molding Shop, 200p., 1981, 47.00, (ISBN 0-9961072-3-1), Heyden.

Reinforced Plastics, 1981, 900.00, (ISBN 0-68633274-1, T63), Predicasts, Inc.

Reinforced Plastics Industry, 1982, 900.00 (ISBN 0-89336-267-0, 0-055), BCC.

Richardson, Terry, Modern Industrial Plastics, LC 72-92621, 17.95, (ISBN 0-672-97279-4), Bobbs. *

Robinson, J.S., ed. Extrusion of Plastic, 300p., (Orig.), 1982, pap 45.00, (ISBN 0-942378-01-6), Polymers & Plastics Tech. Pub. House.

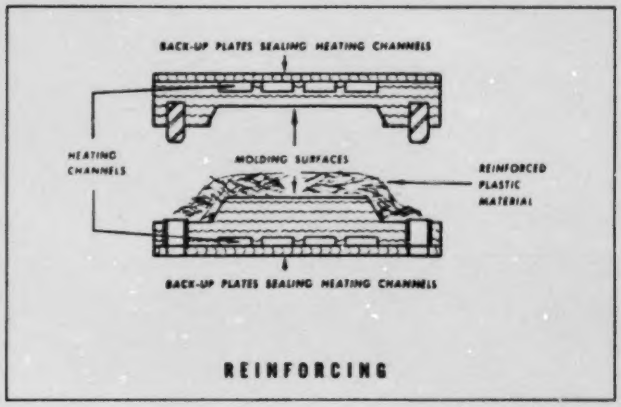
Robinson, J.S., ed., Plastics Molding, Equipment, Processes, & Materials, LC 81-90745, X. 299p., 1981, pap. 42.00 (ISBN 0-942378-00-8), Polymers & Plastics Tech. Pub. Hse.

Robinson, J.S. ed., Spinning, Extruding & Processing of Fibers: Recent Advances, LC 80-13137, (Chemical Technology Review Set, No. 159), 436p. 1980, 48.00, (ISBN 0-8155-080-8), Noyes.

Sacharow, Stanley & Griffin, Roger C. Jr., Basic Guide to Plastics in Packaging, LC 72-91986, 1973, 22.95, (ISBN 0-8436-1208-8), C[illegible]Pub.

Schleicher, Rober, Building Plastic Models, LC 76-10915, (Orig), 1976, 4.75, (ISBN 0-89024-527-4), Kalmbach.

Schwartz, Seymour & Goodman, Sidney, Plastics Materials & Processes, 832p., 1982, text ed. 89.50, (ISBN 0-442-22777-9), Van Nos Reinhold.



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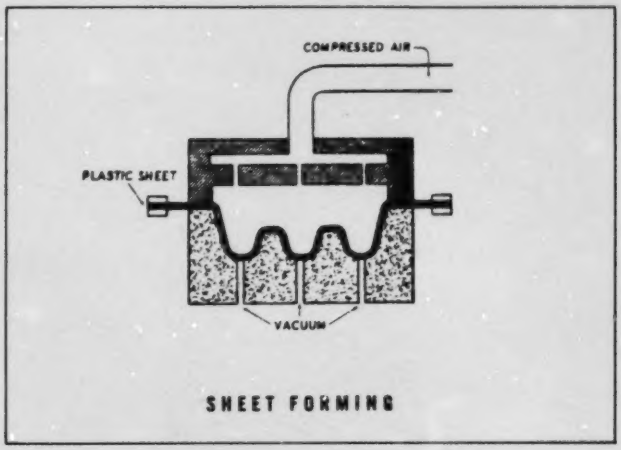
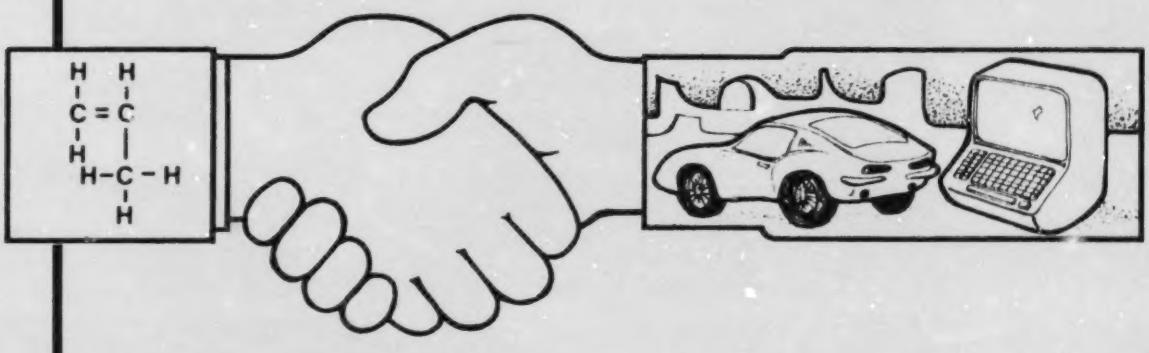


SHEET FORMING

APPENDICES



BEST COPY AVAILABLE

Seymour, Raymond B., Additives for Plastics, 2 Vols., Vol. 1, State of the Art, 27.00, (ISBN 0-12-637501-1), Vol. 2, New Developments, 16.00, (ISBN 0-12-637502-X), 1978, Acad Pr.

Seymour, Raymond B., Modern Plastics Technology, (Illus.) 256p., 1975, 18.95, (ISBN 0-87909-500-8), Reston.*

Seymour, Raymond B., ed. Plastic Mortars, Sealants, & Calking Compounds, LC 79-19752, (ACS Symposium Ser: No. 113), 1979, 2425, (ISBN 0-8412-0523-X), Am Chemical.*

Society of the Plastics Industry, Plastics Industry Safety Handbook, Rosato, D.V. & Lawrence, John R., eds. LC 72-91982, 1973, 18.95, (ISBN 0-8436-1207X) CBI Pub.

_____, Fire Safety Aspects of Polymeric Materials: Vol. 7, Building, 19.00, 1979, 210p., Technomic, Pub.

_____, Plastics in Building/Construction, 12 issues, 12-16p., 65.00, Technomic.

_____, U.S. Foamed Plastics Markets & Directory 1983, 1983, 68p., softcover 8 1/2 x 11, 40.00, Technomic.

_____, Engineering Guide to Plastics Plant Layout & Machine Selection, 1978, 109p., softcover, 9.95, Technomic.

_____, Salary Survey No. 12, 1980, The Society of Plastics Industry, Inc., New York, 1983.

_____, 1982 Annual Labor Survey No. 44; The Society of Plastics Industry, Inc., New York, 1983.

_____, Facts and Figures of the Plastic Industry, 1982; The Society of Plastics Industry, New York, 1983.

_____, SPI Safety Handbook, CBI Publishing Company, Inc., 51 Sleeper Street, Boston, MA 02210, 1983.

_____, Quality Assurance Report, The Society of Plastics Industry, New York, 1983.

_____, Product Showcase '82, The Society of Plastics Industry, New York, 1983.

_____, Practices of Plastic Custom Extrudes, The Society of Plastic Industry, New York, 1983.

_____, Product Liability, The Society of Plastics Industry, New York, 1983.

_____, Customs and Practices of the Moldmaking Industry, The Society of Plastics Industry, New York, 1983.

Steele, Gerald L., Exploring the World of Plastics, LC 75-42964, (gr. 8-12), 1977, text ed, 17.16, (ISBN 0-87345-411-1), McKnight.*

Storage of Cellular Rubber & Plastics, (Two Hundred Set), 1974, pap. 2.00, (ISBN 0-685-58171-3, 231B), Natl. Fire Prot.

Storing, Handling, & Use of Pyroxylin Plastics in Factories (Forty Set), 1967, pap. 2.00, (ISBN 0-685-58100-4, 42), Natl Fire Prot.

Structural Plastics-Properties & Possibilities, 248p., 1969, pap. text ed. 6.50, (ISBN 0-87262-015-8), Am Soc. Civil Eng.

Swanson, Robert S., Plastic Technology, Basic Processes, (gr. 11-12), 1965, text ed. 14.64, (ISBN 0-87345-483-9), McKnight.*

Technomic's Staff, ed. Cellular Plastics in Transportation, LC 7532680, 1975, pap. 9.95x. (ISBN 0-685-63886-3), Technomic.

Time-Life Books Editors, Working with Plastics, LC 81-18459, (Home Repair & Improvement Ser: No. 31), (Illus.), 128p., 1982, 11.95, (ISBN 0-8094-3506-3), Time Life.

Tobin, William J., Quality Control Manual for Injection Molding, 85p., 1978, 19.50, (ISBN 0-938648-13-6), Time-Life.

Webber, T.G., Coloring of Plastics, 220p., 1979, 34.95, (ISBN 0-471-92327-3 Pub. by Wiley-Interscience), Wiley.

Wendle, Bruce C., et. al, eds., Engineering Guide to Structural Foams, LC 76-16932., (Illus.), 1976, pap. 25.00x, (ISBN 0-87762-218-3).

World Plastics to 1995, 1982, 900.00, (ISBN 686-33252-0, T66), Predicasts, Inc.

Zechlin, Katharine, Setting in Clear Plastic, LC 75-164672, (Illus.), 1972, 4.95, (ISBN 0-8008-7070-0), Taplinger.

*Book Suitable for use as text in the industrial arts, plastic technology classes.

16 MM Films

TITLE: All About Plastics
LEVEL: Not Given
SOURCE: BFA; Produced by Kingsp
COST: Not Given
LENGTH: Not Given
COPYRIGHT/RELEASE DATE: 1972
DESCRIPTION: Explores the incredible wide variety of ways which plastic is molded, formed and used; color.

TITLE: Career Opportunities - Metal Finishing Industries
LEVEL: J,C,A
SOURCE: AIMS
COST: $280, RENTAL: $30
LENGTH: 17 minutes
COPYRIGHT/RELEASE DATE: 1973
DESCRIPTION: Shows what is involved in a close relationship with people in the production of finishing metals, plastics, automotive and electronic parts with gold, silver, and chrome. Describes how people with little or no education, who started at the bottom are rising to manage their own companies.

TITLE: Concepts of Dislocations
LEVEL: C
SOURCE: BYU
COST: On Request
LENGTH: 7 minutes
COPYRIGHT/RELEASE DATE: 1975
DESCRIPTION: Animation describes what takes place when dislocation occurs. Relationship between edge and screw dislocations, slip planes, dislocation loops and mixed dislocations. Plastic deformation taking place at low stress levels is illustrated; color.

TITLE: Considering Crystals
LEVEL: I,C
SOURCE: BFA
COST: Not Given
LENGTH: 16 minutes
COPYRIGHT/RELEASE DATE: 1970
DESCRIPTION: Describes the changes that occur in crystals as temperatures and pressure change. Shows importance of crystallography in steelmaking, plastic synthesis, and electronics.

TITLE: Conteneurs
LEVEL: N,G
SOURCE: ASTF
COST: Not Given
LENGTH: 9 minutes
COPYRIGHT/RELEASE DATE: 1971
DESCRIPTION: A French language film. Shows the manufacture and distribution of various types of containers.

TITLE: Countdown to Conversion
LEVEL: Not Given
SOURCE: CARLON
COST: Not Given
LENGTH: 14 minutes
COPYRIGHT/RELEASE DATE: 1975
DESCRIPTION: Introduces a new concept in plastic electrical conduit; color.

TITLE: Fire Plastics
LEVEL: J,H,C
SOURCE: PHENX
COST: Not Given
LENGTH: 22 minutes
COPYRIGHT/RELEASE DATE: 1976
DESCRIPTION: Presents a segment of the television special "fire" from the ABC program, "Close Up," and the hazards of polyurethene. Illustrates how quickly this plastic, which is used in construction throughout the U.S., can spread a fire. Shows the toll in human lives which has been brought about by the hesitancy of the U.S. government and industry to prevent its use; color.

TITLE: Focus on Foam
LEVEL: Not Given
SOURCE: DCC
COST: Not Given
LENGTH: 20 minutes
COPYRIGHT/RELEASE DATE: Not Given
DESCRIPTION: Describes the differences in plastic foams (styrofoam, ethafoam, thurane, dorvon) including manufacturing processes. Shows the installation processes for various application and examples of finished buildings.

TITLE: Future Clear
LEVEL: Not Given
SOURCE: WSTGLF
COST: Not Given
LENGTH: 18 minutes
COPYRIGHT/RELEASE DATE: 1974
DESCRIPTION: Traces the evolution of synthetic acrylic and illustrates its potential in various professions such as art, architecture and industrial design; color.

TITLE: High and Dry
LEVEL: Not Given
SOURCE: DCC
COST: Not Given
LENGTH: 13 minutes
COPYRIGHT/RELEASE DATE: Not Given
DESCRIPTION: Tells of the increasing use of styrofoam, dow formed polystyrene, in floating docks and wharfs. Includes a discussion by experts of design principles and tells basic steps in putting together a floating structure; color.

TITLE How to Crack the Establishment
LEVEL: J,H
SOURCE: PEF
COST: Free
LENGTH: 18 minutes
COPYRIGHT/RELEASE DATE: 1972
DESCRIPTION: The film, in full color, shows the usage of plastic products materials in racing, surfing and rockets. Cleared for TV. Borrower pays the return postage; can fill all requests; book three months in advance. Request on official stationery by school administrator, librarian or teacher. Mention "Educators Guide to Free Films" from which you need date from current catalog; list two alternate showing dates.

TITLE: Image - Therimage
LEVEL: N,G
SOURCE: DENNSN
COST: N,C
LENGTH: 10 minutes
COPYRIGHT/RELEASE DATE: 1974
DESCRIPTION: Explains the therimage process developed by Dennison Manufacturing Company and shows its use in applying high-quality gravure printed labels to plastic blow molded containers. Emphasizes design flexibility, full color reproduction, speed and dependability of the process.

TITLE: Industrial Laminates--Key to Production Innovation
LEVEL: Not Given
SOURCE: MTP
COST: Not Given
LENGTH: 15 minutes
COPYRIGHT/RELEASE DATE: Not Given
DESCRIPTION: Describes the manufacture of plastic laminates. Discusses their use, which range from simple toys to sensitive instruments; color.

TITLE: Injection Machine Operator-A Visual Job Training Program
LEVEL: High School
SOURCE: Not Given
COST: $279.00-16 mm or 3/4" tape $259.00
LENGTH: 20 minutes
DESCRIPTION: This program was developed to familiarize the potential or new operator with the responsibilities of their job. It helps to develop an awareness in the operator of the safety inherent to the process and the inspection requirements inherent to their job. It will help students understand the importance of maintaining a molding cycle, the procedure for inspecting molded parts, and the right way to operate machines, and auxiliary equipment. Includes many industrial scenes and excellent views of large injection molding equipment. Available as a 16 mm or a three quarter inch video cassette tape. Plastic Education Foundation, 1913 Central Avenue, Albany, New York, 12205.

TITLE: Injection Molding Safety
LEVEL: High School
SOURCE: Not Given
COST: Film $195.50, Participant Workbook $5.25, Leaders Guide $5.25
LENGTH: 20 minutes
COPYRIGHT/RELEASE DATE: Not Given
DESCRIPTION: Teaches proper attitudes toward safely operating plastics injection molding machines. Safety concepts include respect for safety features built into machines, how workers need to protect themselves, how workers may develop a "common sense" approach to safety, and the correct way to load, operate, and purge injection molding machines. Includes input from several industrial safety experts, plastics processors, and resin supliers. Includes many industrial scenes and excellent views of large injection molding equipment being safely operated. Plastic Education Foundation, 1913 Central Ave., Albany, NY 12205

TITLE: Inside the Injection Mold
LEVEL: Not Given
SOURCE: DCC
COST: Not Given
LENGTH: 17 minutes
COPYRIGHT/RELEASE DATE: Not Given
DESCRIPTION: Shows the plastic behavior inside the injection mold while the cavity is being filled and the effects of gate sizes, bubbles and inserts; color.

TITLE Magic Molecule
LEVEL: Not Given
SOURCE: NFBC
COST: Not Given
LENGTH: 9 minutes
COPYRIGHT/RELEASE DATE: Not Given
DESCRIPTION: Shows the new world created by the techniques and processes of the plastics industry. Explores the colorful, versatile world of man-made materials; color.

TITLE: Maintenance of Plexiglass and Lucite
LEVEL: Not Given
SOURCE: NF
COST: Not Given
LENGTH: 38 minutes
COPYRIGHT/RELEASE DATE: Not Given
DESCRIPTION: Demonstrates how to clean plexiglass and lucite using soap and water and recommended cleansing fluids. Shows how to remove scratches and repair a crack or bullet hole; black and white.

TITLE: Man-Made Macromolecules
LEVEL: H,C
SOURCE: Kent State
COST: $15.75
LENGTH: 24 minutes
COPYRIGHT/RELEASE DATE: 1978
DESCRIPTION: Studies the polymerization of polyethylene, propylene, and nylon 6-6. Traces the history of each of these man-made plastics from their intended or accidental discovery to their development and application to industry. Shows the polymerization of propylene in the laboratory, and demonstrates the processes through which nylon 6-6 is created; color.

TITLE: Miracle in Color
LEVEL: Not Given
SOURCE: DCC
COST: Not Given
LENGTH: 22 minutes
COPYRIGHT/RELEASE DATE: Not Given
DESCRIPTION: Begins with the birth of latex in the Dow Labs and carries through the final application of latex in your home or office building; color.

TITLE: Peter Alexander
LEVEL: H,C,A
SOURCE: IU
COST: Not Given
LENGTH: 30 minutes
COPYRIGHT/RELEASE DATE: 1971
DESCRIPTION: Studies the life of sculptor Peter Alexander. Shows him mixing colors and casting his plastic pieces.

TITLE: Piping the Problem Liquids
LEVEL: H,C,A
SOURCE: DCC
COST: Free
LENGTH: 22 minutes
COPYRIGHT/RELEASE DATE: Not Given
DESCRIPTION: This film, in full color, illustrates the development of plastic lined steel pipe for the safe and sanitary piping of caustic acids. (Available in Canada) Borrower pays the return postage and insurance of no less than $120.00. Borrower is responsible for loss and/or damage to film. Will not mail to a P.O. Box. Book at least two months in advance and return immediately after showing. Request on official stationery by school administrator, librarian or teacher only. Mention "Educators Guide to Free Films" and date of current catalog. List two alternate showing dates.

TITLE: Plastic Journey
LEVEL: H,C,A,
SOURCE: UNIVIL
COST: $12
LENGTH: 19 minutes
COPYRIGHT/RELEASE DATE: 1972
DESCRIPTION: Explains how plastic materials were discovered; illustrates methods of transporting plastic pellets and describes the injection molding processes and types of machines used. States that plastic pellets actually began as a billard ball when, in 1863, John H. Pike developed a formula for celluloid. At the Ford Motor Plant in Saline, Michigan, the manufacture of plastic auto parts is demonstrated; color.

TITLE: Plastic Journey
LEVEL: H,C,A
SOURCE: UMICH
COST: Not Given
LENGTH: 19 minutes
COPYRIGHT/RELEASE DATE: 1973
DESCRIPTION: Shows how plastic materials were discovered, explains methods of transporting pellets and describes types of machines used and products made in the plastic injection molding process; color.

TITLE: Plastic Shells--How They Were Developed
LEVEL: Not Given
SOURCE: MTP
COST: Not Given
LENGTH: 16 minutes
COPYRIGHT/RELEASE DATE: Not Given
DESCRIPTION: Illlustrates through time lapse photography the development of plastic shotgun shells that can withstand cold and moisture; color.

TITLE: Plastics
LEVEL: High School
SOURCE: Not Given
COST: Not Given
LENGTH: 15 minutes
DESCRIPTION: Highlights the growth of plastics as an important commercial item. Emphasizes the possibilities of the development andLuses of plastics. Indicates that many industrial and home uses are being created.

TITLE: Plastics-A Series
LEVEL: Not Given
SOURCE: DUART
COST: Not Given
LENGTH: See Below
COPYRIGHT/RELEASE DATE: Not Given
DESCRIPTION: Series of eight films as follows: Compression Molding, Part 1, Preparing The...--11 min.; Compression Molding, Part 2, Molding A...--10 min.; Finishing Molded Parts--14 min.; Injection Molding, Part 1, Setting Up the Press--16 min.; Injection Molding, Part 2, Cleaning--12 min.; Matching Laminated Plastics--19 min.; Methods of Processing Plastic Materials--16 min.; Transfer Molding--Molding A Part With Inserts--10 min.

TITLE: Plastics: Industrial Processes and Products
LEVEL: High School
SOURCE: Not Given
COST: Not Given
LENGTH: 24 minutes
DESCRIPTION: Explains the principles of basic manufacturing processes of the plastics industry and their applications to the production of consumer goods. Uses animation and scenes in plants to develop the meanings of the following terms: thermoplastic, thermoset, compression molding, transfer molding, injection molding, extrusion, blow molding, expansion, lamination, and thermo-forming.

TITLE: Plastics--Their Processing
LEVEL: Not Given
SOURCE: Not Given
COST: Not Given
LENGTH: 20 minutes
DESCRIPTION: Composition of plastics. Uses intaglio printing of film for decorative purposes, tablecloths, curtains, laminated panels, flooring tiles, plastic foams.

TITLE: Plastics and Fiberglass--A Series
LEVEL: H,C
COST: Not Given
LENGTH: 13 minutes each
COPYRIGHT/RELEASE DATE: Not Given
DESCRIPTION: Covers topics on fiberglass and thermoplastics (2 separate films).

TITLE: Plastics From Petroleum
LEVEL: Not Given
SOURCE: Not Given
LENGTH: 15 minutes
DESCRIPTION: Shows the creation of plastics as a part of petroleum research. Explains basic compounds and shows injection molding, lamination, extrusion and finished articles.

TITLE: Plastics in Art and Industry
LEVEL: H,C,A
SOURCE: UEVA
COST: Not Given
LENGTH: 16 minutes
COPYRIGHT/RELEASE DATE: 1970
DESCRIPTION: Describes the production of familiar plastic items, from raw materials to finished article. Shows how extrusion, injection molding, vacuum forming and blow molding are used to produce many of the objects found in the home, school, automobile and office. Explores other uses and new developments of plastics in art and design; color.

TITLE: Reinforced Plastics--Inspection and Quality Control
LEVEL: Not Given
SOURCE: NF
COST: Not Given
LENGTH: 20 minutes
COPYRIGHT/RELEASE DATE: Not Given
DESCRIPTION: Demonstrates inspection procedures, showing examples of various common defects and procedures leading to final acceptance of the finished parts by naval inspectors; color.

TITLE: Reinforced Plastics--Introduction
LEVEL: Not Given
SOURCE: NF
COST: Not Given
LENGTH: 20 minutes
COPYRIGHT/RELEASE DATE: Not Given
DESCRIPTION: Explains in general the nature of reinforced plastics and their composition and fabrication; black and white.

TITLE: Reinforced Plastics--Repair of Single Skin Failures
LEVEL: Not Given
SOURCE: NF
COST: Not Given
LENGTH: 19 minutes
COPYRIGHT/RELEASE DATE: Not Given
DESCRIPTION: Demonstrates methods of repairing single skin reinforced plastic parts with illustration of different kinds of damage; black and white.

TITLE: Resource Recovery
LEVEL: Not Given
SOURCE: BCDA
COST: Not Given
LENGTH: 25 minutes
COPYRIGHT/RELEASE DATE: 1974
DESCRIPTION: Shows the recovery and remanufacturing of glass, metal, paper and plastic; color.

TITLE: Safe at Work in Plastics Extrusion
LEVEL: High School
SOURCE: Not Given
COST: Film $287.00, Participant Workbook $5.25, Leader's Guide $6.90
LENGTH: 20 minutes
COPYRIGHT/RELEASE DATE: Not Given
DESCRIPTION: Teaches proper attitudes toward the safe operation of plastics extruder equipment. Safety concepts include correct eye, arm, hand and foot protection. Other potential hazards are noted. Includes many industrial scenes and excellent views of large extrusion equipment being safely operated. Plastic Education Foundation, 1913 Central Ave., Albany, NY 12205.

TITLE: Sawdust
LEVEL: Not Given
SOURCE: HARMON
COST: Not Given
LENGTH: 15 minutes
COPYRIGHT/RELEASE DATE: Not Given
DESCRIPTION: Describes the process of converting sawdust from waste product into a useful plastic; black and white.

TITLE: Skin
LEVEL: N,G
SOURCE: ENVIC
COST: Not Given
LENGTH: 15 minutes
COPYRIGHT/RELEASE DATE: 1971
DESCRIPTION: Shows how vinyl skins are made by the casting-on-paper process, and tells how they are used for fashion products.

TITLE: Tupperware Home Parties Wonderland Jubilee
LEVEL: N,G
SOURCE: SHAROE
COST: Not Given
LENGTH: 26 minutes
COPYRIGHT/RELEASE DATE: 1970
DESCRIPTION: Film for salespersons and potential salespersons about the activities during the tupperware sales jubilee week.

TITLE: Urethanes--Challenge of Change
LEVEL: Not Given
SOURCE: UPJOHN Corp. Film Library
COST: Not Given
LENGTH: 25 minutes
COPYRIGHT/RELEASE DATE: Not given
DESCRIPTION: UPJOHN Corporation Film Library, 7171 Portage Road, Kalamazoo, Michigan 49001.

TITLE: Vacuum Forming Machine Operator--A Visual Job Training Program
LEVEL: High School
SOURCE: Not Given
COST: 16 mm $289.00 or 3/4" tape $269.00
LENGTH: 20 minutes
DESCRIPTION: This program was developed to familiarize the potential or new operator with the responsibilities of their job. It helps to develop an awareness in the operator of the safety inherent to the process and the inspection requirements inherent to their job. It will help students understand the importance of maintaining a molding cycle, the procedure for inspecting thermoformed parts and the right way to operate machines and auxiliary equipment. Shot exclusively in industrial plants with excellent views of large thermoforming equipment. Available as a 16 mm or a three quarter inch video cassette tape. Plastic Education Foundation, 1913 Central Avenue, Albany, New York, 12205.

TITLE: What's Happened Since Fire
LEVEL: Not Given
SOURCE: PHENIX
COST: Not Given
LENGTH: 13 minutes
COPYRIGHT/RELEASE DATE: 1976
DESCRIPTION: Based on the television special "fire" the ABC series "Close-Up." Includes the controversial test burning of a baby's crib made of polystyrene and interviews with the president of the American Plastics Association. Reports the progress and need for consumer fire safety protection; color.

TITLE: The World of Acrylics
LEVEL: J,H
SOURCE: RAH
COST: Not Given
LENGTH: 18 minutes
COPYRIGHT/RELEASE DATE: Not Given
DESCRIPTION: Relates man's use of material to the age in which he lives. Shows uses of plastics, especially plexiglass, in art, industry, architecture and the classroom; color.

Abbreviations and Addresses for Film Sources

AIMS (AIMS Instructional Media Services, Inc.)
626 Justin Avenue
Glendale, CA 91201

ASTF (Association of Sterling Films)
866 Third Avenue
New York, NY 10022

BCDA (British Columbia Department of Agriculture
Information Branch

BFA (BFA Educational Media)
2211 Michigan Avenue, Post Office Box 1795
Santa Monica, CA 90406

BYU (Brigham Young University)
Educational Media Center
290 Herald R. Clark Building
Provo, UT 84602

CARLON (Carlon, An Indian Head Company)

DCC (Dow Chemical Company)
Audio-Visual Department Film Library
2030 Dow Center
Midland, MI 48640

DENNSN (Dennison Manufacturing Company)

DUART (Du Art Film Labs, Inc.)
245 West 55th Street
New York, NY 10019

ENVIC (Envision Corporation)
323 Newbury Street
Boston, MA 02115

EXXON (Modern Talking Picture Service, Inc.)
Film Scheduling Department
5000 Park Street North
St. Petersburg, FL 33709

FTRC (Firestone Tire & Rubber Company)
Department of Public Relations
1200 Firestone Parkway
Akron, OH 44317

GE (General Electric Company)
Educational Films
Corporation Park, Building 705
Scotia, NY 12302

HARMON (Harmon Foundation, Inc.)
598 Madison Avenue
New York, NY 10022

IU (Indiana University)
Audio-Visual Center
Bloomington, IN 47401

KENT STATE (Kent State University)
Audio Visual Services
Kent, OH 44242

LCOA (Learning Corporation of America)
711 Fifth Avenue
New York, NY 10022

MTP (Modern Talking Picture Service)
2323 New Hyde Road
New Hyde Park, NY 11040

NF (Norwood Films)
Post Office Box 1894, Wheaton Post Office
Silver Spring, MD 20902

NFBC (National Film Board of Canada)
1251 Avenue of the Americas, 16th Floor
New York, NY 10020

PEF (Plastics Education Foundation)
Post Office Box 12443
Albany, NY 12212

PHENIX (Phoenix Films, Inc.)
470 Park Avenue South
New York, NY 10016

RAH (Rahm and Haas Company)
Independence Mall West
Philadelphia, PA 19105

SF (Sterling Educational Films)
241 E. 34th Street
New York, NY 10016

SHAROE (Shattuck/Roether Advertising)

UEVA (Universal Education and Visual Arts)
100 Universal City Plaza
Universal City, CA 91608

UMICH (University of Michigan)
Audio Visual Education Center
416 Fourth Street
Ann Arbor, MI 48103

UNIPUB (No additional information was given)

UNIVIL (University of Illinois)
Film Center
1325 South Oak Street
Champaign, IL 61820

WSTGLF (West Glen Films)
565 Fifth Avenue
New York, NY 10017

Slide and Cassette Materials

TITLE: Blow Extrusion Molding
LEVEL: High School
SOURCE: Howard W. Sams
COST: $72.50
COPYRIGHT/RELEASE DATE: Not Given
SOUND: Cassette
TYPE: Slides
DESCRIPTION: Principle of blow molding a product from a paison; materials used for blow molding; mold requirements; setting up the equipment and running it; making blown film; typical high school product suggestions. Plastic Education Foundation, 1913 Central Ave., Albany, NY 12205 (20 min)

TITLE: Career Guidance
LEVEL: High School
SOURCE Howard W. Sams
COST: $124.93
COPYRIGHT/RELEASE DATE: Not Given
SOUND: Cassette
TYPE: Slides
DESCRIPTION: Applications of plastics; where plastics come from; interviews with plastics company employees; president, production manager, engineering director, sales vice-president, inspector, tool-and-die maker, lead man, machine operator; working with people, ideas, and hands. Plastic Education Foundation, 1913 Central Ave., Albany, NY 12205 (20 min)

TITLE: Cast Epoxy Tooling
LEVEL: High School and Junior High
SOURCE: Howard W. Sams
COST: $67.50
LENGTH: 10 minutes
COPYRIGHT/RELEASE DATE: Not Given
SOUND: Cassette
TYPE: Slides
DESCRIPTION: Preparing the model; preparing the molding board and coddle; fillers and materials used for cast epoxy tooling; mixing and pouring the epoxy; removing the model and finishing the mold; typical applications where epoxy molds may be used in plastics processing.

TITLE: Casting and Encapsulating
LEVEL: Junior High and High School
SOURCE: Howard W. Sams
COST: $67.50
LENGTH: 12 minutes
COPYRIGHT/RELEASE DATE: Not Given
SOUND: Cassette
TYPE: Slides
DESCRIPTION: Resins used for casting; mold and product design; technique for successfully casting clear polyester resins; typical junior high school products.

TITLE: Coatings
LEVEL: High School
SOURCE: Howard W. Sams
COST: $67.00
LENGTH: 12 minutes
COPYRIGHT/RELEASE DATE: Not Given
SOUND: Cassette
TYPE: Slides
DESCRIPTION: Concepts of fluidized bed coating; concepts of vinyl dip coating; mold and mandrel designs; procedure for cold and hot dipping; typical junior high school product suggestions. Plastic Education Foundation, 1913 Central Ave., Albany, NY 12205.

TITLE: Compression and Transfer Molding
LEVEL: High School
SOURCE: Howard W. Sams
COST: $83.75
LENGTH: 20 minutes
COPYRIGHT/RELEASE DATE: Not Given
SOUND: Cassette
TYPE: Slides
DESCRIPTION: Designation of thermosets and material; molding technique and procedure for thermosets; mold requirements; materials requirements; operating the compression press; removing parts and trimming; sample high school product suggestions. Plastic Education Foundation, 1913 Central Ave., Albany, NY 12205

TITLE: Ecology of Plastics
LEVEL: High School
SOURCE: Howard W. Sams
COST: $123.75
LENGTH: Not Given
COPYRIGHT/RELEASE DATE: Not Given
SOUND: Cassette
TYPE: Slides
DESCRIPTION: This program studies the various types of solid wastes and their sources. It details the four specific methods by which society may usefully dispose of solid wastes; recycling, degrading, sanitary landfilling, and incinerating. The various types of plastics are thoroughly discussed as they relate to accumulated solid waste. Many specific suggestions are included for recycling discarded plastic products. Activities are demonstrated in which recycled plastics may be used for plastics laboratory projects. Safety procedures and considerations are intergrated throughout the program. Plastic Education Foundation, 1913 Central Ave., Albany, NY 12205

TITLE: Energy-Saving Capabilities of Rigid Polyurethane Foam Insulators
LEVEL: Not Given
SOURCE: The Society of the Plastic Industry
COST: $75.00 ($10 loan)
LENGTH: 80 slides plus script
COPYRIGHT/RELEASE DATE: Not Given
TYPE: Slides
DESCRIPTION: Cost effectiveness of rigid polyurethane foam for thermoinsulation purposes.

TITLE: Fabrication of Thermoplastics
LEVEL: High School
SOURCE: Howard W. Sams
COST: $123.75
LENGTH: Not Given
COPYRRIGHT/RELEASE DATE: Not Given
SOUND: Cassette
TYPE: Slides
DESCRIPTION: Six primary methods used to join and fabricate thermoplastics products; spin welding; ultrasonic welding; dielectric welding; hot air welding; chemical welding and adhesive bonding. The advantages and disadvantages of each process are discussed. Slides depict industrial products and processes as well as products that may be made in a school shop environment. Specific procedures are outlined for producing the small school projects. Safety considerations and procedures are well integrated throughout the program. Plastic Education Foundation, 1913 Central Ave., Albany, NY 12205

TITLE: Flexible Mold Making
LEVEL: High School
SOURCE: Howard W. Sams
COST: $83.75
LENGTH: 20 minutes
COPYRIGHT/RELEASE DATE: Not Given
SOUND: Cassette
TYPE: Slides
DESCRIPTION: Preparing the pattern; preparing the molding box and coddle; materials used for flexible mold making; urethanes, silicones; mixing procedure; pouring procedure; removing mold from the pattern; typical application of flexible molds. Plastic Education Foundation, 1913 Central Ave., Albany, NY 12205

TITLE: Foam Molding
LEVEL: High School
SOURCE: Howard W. Sams
COST: $98.75
LENGTH: 20 minutes
COPYRIGHT/RELEASE DATE: Not Given
SOUND: Cassette
TYPE: Slides
DESCRIPTION: Technique used for molding with polyurethane foam; techniques used for molding using styrene expandable bead foam; removing and finishing the part; typical application of rigid and flexible foams. Plastic Education Foundation, 1913 Central Ave., Albany, NY 12205

TITLE: Hot Air Welding
LEVEL: High School
SOURCE: Howard W. Sams
COST: $76.24
LENGTH: 10 minutes
COPYRIGHT/RELEASE DATE: Not Given
SOUND: Cassette
TYPE: Slides
DESCRIPTION: Concept of hot air welding of thermoplastics; filler rods; air or gas supply; technique in welding; typical junior high school applications. Plastic Education Foundation, 1913 Central Ave., Albany, NY 12205

TITLE: Injection Molding
LEVEL: High School
SOURCE: Howard W. Sams
COST: $91.25
LENGTH: 20 minutes
COPYRIGHT/RELEASE DATE: Not Given
SOUND: Cassette
TYPE: Slides
DESCRIPTION: Principle involved in injection molding; plasticizing using the plunger and screw methods; mold requirements; setting up and running the molder; removing and trimming the parts; sample high school projects. Plastic Education Foundation, 1913 Central Ave., Albany, NY 12205

TITLE: Low and High Pressure Laminating
LEVEL: High School
SOURCE: Howard W. Sams
COST: $76.25
LENGTH: 20 minutes
COPYRIGHT/RELEASE DATE: Not Given
SOUND: Cassette
TYPE: Slides
DESCRIPTION: Low pressure laminating of thermoplastics; high pressure laminating of thermosets; types of preimpregnated material; making a copyboard as a typical high school product. Plastic Education Foundation, 1913 Central ave., Albany, NY 12205

TITLE: Material Identification
LEVEL: High School
SOURCE: Howard W. Sams
COST: $124.93
LENGTH: 20 minutes
COPYRIGHT/RELEASE DATE: Not Given
SOUND: Cassette
TYPE: Slides
DESCRIPTION: Identification by function; thermoplastics and thermosets; testing by feel; testing by appearance; testing by sound; burning; solubility test; specific gravity; impact strength; different uses of plastics; safety precautions. Plastic Education Foundation, 1913 Central Ave., Albany, NY 12205

TITLE: Overview
LEVEL: Not Given
SOURCE: The Plastics Pipe Institute
COST: $65.00
LENGTH: 100 slides
COPYRIGHT/RELEASE DATE: Not Given
TYPE: Slides
DESCRIPTION: A presentation of the various aspects in designing, installing and operating a plastic piping system; provides introduction to standards, codes and regulations and review of joining methods.

TITLE: Packaging
LEVEL: High School
SOURCE: Howard W. Sams
COST: $124.93
LENGTH: 20 minutes
COPYRIGHT/RELEASE DATE: Not Given
SOUND: Cassette
TYPE: Slides
DESCRIPTION: Packaging of consumer goods; sheet film and blown film process; heat sealing machine; thermoforming; blister packaging; skin packaging; plastic foams; shrink film; blow molding; injection molding; printing and decorating; ecological considerations. Plastic Education Foundation, 1913 Central Ave., Albany, NY 12205

TITLE: Plaster Tooling
LEVEL: High School
SOURCE: Howard W. Sams
COST: $83.75
LENGTH: 16 minutes
COPYRIGHT/RELEASE DATE: Not Given
SOUND: Cassette
TYPE: Slides
DESCRIPTION: Preparing the model; preparing the molding board and coddle; mixing and pouring the gypsum cement; removing the pattern and making a split mold; typical plastics processing applications using plaster tooling. Plastic Education Foundation, 1913 Central Ave., Albany, NY 12205

TITLE: Plastics and Ecology
LEVEL: Not Given
SOURCE: Bobbs-Merrill Educational Publishing
COST: $34.00
LENGTH: 51 slides
COPYRIGHT/RELEASE DATE: Not Given
SOUND: Cassette
TYPE: Slides
DESCRIPTION: An audio/visual program consisting of 51 slides and a coordinated cassette tape which covers the problems and methods of disposing of plastics materials.

TITLE: Polymer Structure
LEVEL: High School
SOURCE: Howard W. Sams
COST: $124.93
LENGTH: 30 minutes
COPYRIGHT/RELEASE DATE: Not Given
SOUND: Cassette
TYPE: Slides
DESCRIPTION: The structure of matter starting with the atom, working up to the giant polymer molecule; taking a trip inside a polyethylene structure; classification and identification of polymer materials. Plastic Education Foundation, 1913 Central Ave., Albany, NY 12205

TITLE: Reinforced Plastics
LEVEL: High School
SOURCE: Howard W. Sams
COST: $106.25
LENGTH: 20 minutes
COPYRIGHT/RELEASE DATE: Not Given
SOUND: Cassette
TYPE: Slides
DESCRIPTION: Polyester and epoxy resins used for reinforced plastics; reinforcements, glass mat, roving, and continuous strands; hand lay-up procedure; typical high school project suggestions. Plastic Education Foundation, 1913 Central Ave., Albany, NY 12205

TITLE: Rotational Molding
LEVEL: High School
SOURCE: Howard W. Sams
COST: $83.75
LENGTH: 15 minutes
COPYRIGHT/RELEASE DATE: Not Given
SOUND: Cassette
TYPE: Slides
DESCRIPTION: Principle involved in biaxial rotation; machines, molds and materials; loading molds and running the machine; removing parts and trimming; typical high school product suggestions. Plastic Education Foundation, 1913 Central Ave., Albany, NY 12205

TITLE: Structure and Chemistry of Plastics
LEVEL: Junior High
SOURCE: Bobbs-Merrill Educational Publishing
COST: $26.20
LENGTH: 18 minutes
COPYRIGHT/RELEASE DATE: Not Given
SOUND: Cassette
TYPE: Slides
DESCRIPTION: This program covers general classification of thermoplastics and thermosets; building blocks of atoms, elements, compounds, molecules, monomers and polymers; polymerization; structure of polymers; and development of plastics from raw materials.

TITLE: Thermoforming
LEVEL: Junior High
SOURCE: Bobbs-Merrill Educational Publishing
COST: $35.00
LENGTH: 20 minutes
COPYRIGHT/RELEASE DATE: Not Given
SOUND: Cassette
TYPE: Slides
DESCRIPTION: This program covers the concept of pressure differential forming; typical materials used for thermoforming and sheet stock; mold requirements; operating the thermoforming machine; finishing and trimming the part; and typical applications and products for thermoforming.

TITLE: Thermoforming
LEVEL: High School
SOURCE: Howard W. Sams
COST: $98.75
LENGTH: 18 minutes
COPYRIGHT/RELEASE DATE: Not Given
SOUND: Cassette
TYPE: Slides
DESCRIPTION: Principle of pressure differential forming; sheet materials used for thermoforming; several techniques including plug-assist, snap-back, and pressure forming; running the equipment; removing the parts and trimming; typical high school product suggestions. Plastic Education Foundation, 1913 Central Ave., Albany, NY 12205

Filmstrips

TITLE: A Class Studies Rubber
LEVEL: I,J
SOURCE: FTRC
COST: Free
LENGTH: 43 Frames
COPYRIGHT/RELEASE DATE: 1977
SOUND: Silent
DESCRIPTION: This filmstrip, in full color, reports on how rubber is made, manufacture of rubber products and the uses of rubber. It is intended to supplement classes studying industries and resources of our nation. This filmstrip may be retained permanently. Teacher, school administrator or librarian should make request well in advance on official stationery. Mention "Educators Guide to Free Films" and give current catalog date: list two alternate showing dates.

TITLE: New Materials
LEVEL: Not Given
SOURCE: UNIPUB
COST: Not Given
LENGTH: 48 frames
COPYRIGHT/RELEASE DATE: Not Given
SOUND: Silent
DESCRIPTION: A study of plastic, new metals and alloys as featured in a traveling science exhibition organized by UNESCO.

TITLE: Synthetics--Engineering the Molecule
LEVEL: C
SOURCE: LCOA
COST: Not Given
LENGTH: Not Given
COPYRIGHT/RELEASE DATE: 1971
SOUND: Record
DESCRIPTION: From a series of filmstrips titled "From the World War I to Tomorrow," which examines several key 20th century inventions with regard to their impact on America.

Video Cassettes

TITLE: Refinery
LEVEL: J,H
SOURCE: EXXON
COST: Free
LENGTH: 14 minutes
COPYRIGHT/RELEASE DATE: 1975
SOUND: Cassette
TYPE: 3/4" u-matic videotape
DESCRIPTION: This program tells the story of crude oil and the production of economic principles behind refining. Extensive animated sequences show how molecules are changed and reformed. The 1975 Cine Golden Eagle Award winner. Ask for free discussion materials available with this film. User pays return postage. Return day after usage via parcel post, special fourth class rate, insured. Book at least three weeks ahead and include alternate date. Not always available. Must specify machine used on. Request should be made by teacher, librarian, or school administrator on official stationery, mentioning "Educator's Guide to Free Films" with current catalog date.

TITLE: Injection Machine Operator-A Visual Job Training Program
LEVEL: High School
SOURCE: Not Given
COST: $279.00-16mm or 3/4" tape $259.00
LENGTH: 20 minutes
SOUND: Not Given
TYPE: 16 mm or 3/4" video cassette tape
DESCRIPTION: This program was developed to familiarize potential or new operators with the responsibilities of their job. It helps to develop an awareness in the operator of the safety and inspection requirements of their job. It will help students understand the importance of maintaining a molding cycle, the procedure for inspecting molded parts, and the right way to operate machines and auxiliary equipment. Includes many industrial scenes and excellent views of large injection molding equipment. Plastic Education Foundation, 1913 Central Ave., Albany, New York, 12205.

TITLE: Vacuum Forming Machine Operator-A Visual Job Training Program
LEVEL: High School
SOURCE: Not Given
COST: 16 mm $289.00 or 3/4" tape $269.00
LENGTH: 20 minutes
SOUND: Not Given
TYPE: 16 mm or 3/4" video cassette tape
DESCRIPTION: This program was developed to familiarize the potential or new operator with the responsibilities of their job. It helps to develop an awareness in the operator of the safety and inspection requirements of their job. It will help students understand the importance of maintaining a molding cycle, the procedure for inspecting thermoformed parts and the right way to operate machines and auxiliary equipment. Shot exclusively in industrial plants with excellent views of large thermoforming equipment. Plastic Education Foundation, 1913 Central Ave., Albany, New York, 12205.

Plastic Periodical List

ADHESIVES AGE - manufacture, application, technology, and sale, 1958, m. $12, Palmerton Publishing Co., Inc., 461-8th Ave., New York, NY, 10001, Ed. N. McMurrer, adv.bk. rev. charts, illus. patents, tr.lit. index. circ. 24,500, (microform), Indexed: A.S. & T.Ind. Chem. Abstr. Eng. Ind. (ISSN 0001-821X).

ADVANCES IN URETHANE SCIENCE AND TECHNOLOGY - 1971, a. $20 price varies, Technomic Publishing Co., Inc. 265 Post Rd. W., Westport, CT 06880, Eds Dr. Kurt C. Frisch & Dr. Signey L. Reegen, charts, illus. stat, index, Indexed: Chem. Abstr. Eng. Ind., (ISSN 0044-6378).

APPLIED PLASTICS - the practical uses of plastics in industry and commerce, 1958, m. 100s ($12), Scientific Press Ltd., 11a Gloucester Rd., London S.W.7, Eng., U.K. adv. abstr. illus., pat. tr. lit. index, Indexed: Br. Tech. Ind. RAPRA Abstr. Incorporating: Reinforced Plastics Review & Plastic News., (ISSN 0003-696X).

AUSTRALIAN PLASTICS & RUBBER - 1949, m. Aus. $1, I P C Business Press (Australia) Pty. Ltd., 3-13 Queen St., Chippendale, N.S.W. 2008, Australia, Ed. Ian Miller, circ. 3,250, Formerly: Plastics in Australia.

BRITISH PLASTICS AND RUBBER - m., Findlay Publications Ltd., 10 Letchworth Drive, Bromley, Kent BR2 9BE, England, Ed. Peter Chambers, adv. charts, illus., tr. lit., Incorporating: Polymer Age.

CANADIAN PLASTICS MAGAZINE - 1943, m. Can. $10, Southam Business, Publications Ltd., 1450 Don Mills, M3B 2X7, Ont., Canada, Ed. Antony Auden, adv. bk. rev. charts, illus, stat. tr.lit. circ. 9,200 Indexed: Can. Ind., Chem. Abstr. RAPRA. (ISSN 0008-4778).

DUREZ MOLDER - 1930, m. free, Hooker Chemicals & Plastics Corp., Durez Division, 528 Walck Rd. N. Tonawanda, NY 14120, Ed. John M. Kam, adv. circ. 18,000 (approx.) (ISSN 0012-7264).

EUROPEAN PLASTICS NEWS - 1929, m. $30, I P C Industrial Press Ltd., 33-40, Bowling Green Lane, London ECIR ONE, Eng. Ed. Richard Rowland, adv. bk. rev. chars, illus., tr. mk. circ. 32,000, (also avail. in microform from UMI), Indexed: A.S.&T. Ind. Br.Tech.Ind. Chem. Abstr. Eng. Ind., RAPRA. Formerly: Europlastics; incorporating: British Plastics (IISN 0007-1625).

INTERNATIONAL JOURNAL OF POLYMERIC MATERIALS - 1971, 4/yr., $75, Gordon and Breach Science Publishers Ltd., 42, William IV St., London W.C2, England. Ed. Herman S. Kaufman, adv. illus. (also avail. in microfiche) Indexed: Chem Abstr. (ISSN 0091-4037).

JAPAN PLASTICS - Japanese edition: Purasuchikkusu (ISSN 0555-7887) (Text in English) 1967, 8/yr., $32, (Japan Plastics Industry Federation - Kogyo Chosakai Co. Ltd.) Japan Press & Service International Co., Ltd., Sankyo Bldg., Room 401, 1-43 Kanda Jimbo-cho, Chiyoda-ku, Tokyo 101, Japan, Ed. Massaru Ishizaka, adv. charts, illus, stat, index circ. 8,700, Indexed: Chem Abstr., (ISSN 0021-4574).

JOURNAL OF APPLIED POLYMER SCIENCE - 1956, m. (plus symposia) $230, Wiley-Interscience, (Subsidiary of: John Wiley & Sons, Inc.) 605 Third Ave., New York, NY, 10016, Ed. Bd. bk. rev. abstr., bibl. charts, illus. index, (microform) Indexed: Appl. Mech, Rev. Chem. Abstr. Curr. Cont. Curr. Cont. Eng. Ind. RAPRA. (ISSN 0021-8995).

JOURNAL OF CELLULAR PLASTIC - 1965, bi-m. $40, Technomic Publishing Co., Inc., 265 Post Rd. W., Westport, CT 06880, Ed. Walter E. Becker, Jor. adv, bk. rev. charts, illus. pat, stat, index, circ. 4,000, Indexed: Appl. Mech. Rev. Chem Abstr. Eng. Ind., (ISSN 0021-955X).

JOURNAL OF ELASTOMERS AND PLASTICS - 1969, q. $60, Technomic Publishing co., Inc. 265 Post Rd. W., Westport, St., Westport, Ct 06880, Ed. Dr. Samuel Steingiser, adv. bk. rev. charts stat. index circ. 500., Indexed: Appl. Mech. Rev. Chem Abstr., Engl., Ind. RAPRA, Formerly Journal of Elastoplastics, (ISSN 0022-071X).

MODERN PLASTICS - 1925, m. $5, McGraw-Hill, Inc., 1221 Ave. of the Americas, New York, NY, 10020, Ed. Sid Grass, adv. bk. rev. abstr., illus., pat. tr. lit. index, circ. 55,000, Indexed: A.S.&T.Ind., Chem. Abstr. Eng. Ind. RAPRA, (ISSN 0026-8275).

MODERN PLASTICS INTERNATIONAL - International edition of Modern Plastics (Text in English), 1971, m. 80 Fr., McGraw-Hill, Inc. 1221 Ave. of the Americas, New York, NY 10020 (Subscr. to 50 Avenue de la Gare, Lausanne, Switzerland) Ed. Julian Kestler, adv. index, circ. 17,000, (ISSN 0026-8283).

PLASTICS - 1974, m. $10, to non-qualified personnel, Western Plastics News, Inc., 1704 Colorado Ave., Santa Monica, CA 90404, Ed. Norry M. Hastings, adv. bk. rev. circ., 10,000, (controlled), Formerly: Western Plastics.

PLASTICS & PACKAGING - 1965 bi-m $7, Dyonr Publications (NZ), Ltd. Box 18-218, Glen Innes, Auckaland, New Zealand, Ed. R.L.J. Smith, adv. charts, illus. mkt., tr.lit, circ, 3,000, 1966.

PLASTICS AND RUBBER MATERIALS AND APPLICATIONS - 1976, $75, (Plastics and Rubber Institute), Peter Peregrinus Ltd., Box 8, Southgate House, Stevenage, Herts SG1 1HQ, England.

PLASTICS AND RUBBER NEWS - 1956 m. r.25($30), Thomson Publications, S.A. (Pty.) Ltd., Box 8308, Johannesburg 2000, South Africa, Ed. Tony Jenkins, adv. bk. rev., charts, illus., tr.lit. circ. 5,000, Indexed: Chem Abstr, RAPRA, Formerly: Plastics, Paint, and Rubber, (ISSN 0032-1222).

PLASTICS DESIGN & PROCESSING - 1961, m. $25, Lake Publishing Corporation, 700 Peterson Rd. Box 159, Libertyville, IL 60048, Ed. Donald Swanson, adv. bk. rev. charts., illus., tr.lit., index. circ 44,000, Indexed: Chem Abstr. RAPRA, (ISSN 0032-1176).

PLASTICS DESIGN FORUM - 1976, bi-m $20, Industry Media, Inc. 1129 E. 17th Ave., Denver, CO 80218, Ed. Mel Freidman, adv. bk. rev. index, circ. 35,000, (controlled) (back issues avail.).

PLASTICS ENGINEERING - 1945, m. $15, Society of Plastics Engineers, 656 W. Putnam Ave., Greenwich, CT 06830, Ed. A.A. Schoengood, adv., bk, rev. charts. illus., pat, stat, index, circ. 22,000, (also avail. in microfilm from UMI), Indexed: A.S.&T.Ind., Chem. Abstr. Eng. Lind. RAPRA, Formerly: S P E Journal (ISSN 0036-1844), (ISSN 0091-9578).

PLASTIC FOCUS - 1969, w. $88, Plastics Focus Publishing Co., Inc., 509 Fifth Ave., New York, NY, 10017, Ed. Joel Frados.

PLASTICS TECHNOLOGY - the magazine of process/production/manufacturing engineering, 1955, m. $12, Bill Communications, Inc., 633 Third Ave., New York, NY 10017, Ed. Malcolm W. Riley, adv. bk. rev. abstr., charts, illus. pat. tr.lit. index, circ. 36,000, Indexed: A.S.&T.Ind. Chem Abstr. Eng. Ind., RAPRA, (ISSN 0032-1257).

PLASTICS TRENDS - 1964, q. $1200, Predicasts, Inc., 200 University Circle Research Center, 11001 Cedar Ave., Cleveland, OH, 44106, Ed. Geoffrey Spaulding, charts, mkt., stat., (ISSN 0032-1265).

PLASTICS WORLD - adaptable information for the plastics managers, processor and designer, 1943, m. $15, Cahners Publishing Co., Inc., 221 Columbus Ave., Boston, MA, 02116, Ed. Leonard Berringer, adv. bk. rev. illus., stat, tr.lit. circ. 56,000, Indexed: A.S.&T. Ind. Chem. Abstr. (ISSN 0032-1273).

PLASTICS WORLD INFORMATION CARDS - 1968, s-a Rogers Publishing Co., Ind., (Subsidiary of Cahners Publishing Co., Inc.,) 270 St. Paul St., Denver, CO 80206, adv. circ 56,221, (cards), (ISSN 0032-1281).

POLYMER ENGINEERING AND SCIENCE - 1961, m. $40 to non-members, Society of Plastics Engineers, 656 W. Putnam Ave., Greenwich, CT 06830, Ed. Roger S. Porter, charts, illus. index, circ. 1,600, (also avail. in microfilm form UMI), Indexed: Chem. Abstr. End. Ind., RAPRA, (ISSN 0032-3888).

POLYMER MECHANICS - English translation of: Mekhanika Polimerov, 1965, bi-m. $165, (Akademiya Nauk Latviiskoi S.S.R.) Consultants Bureau, (Subsidiary of: Plenum Publishing Corp.), 227 W. 17th St., New York, NY 10011. Ed. Jacques P. Suchet, bk. rev. abstr. charts, illus., Index, circ. 157, (also avail. in microfilm; back issues avail.), Indexed: Appl. Mech. Rev. Chem. Abstr. Eng. Ind., (ISSN 0032-390X).

REINFORCED PLASTICS - 1956, m. 16($15), McDonal Publications of London, Ltd., 268 High St., Uxbridge, Middlesex UB8 1UA, Eng. ed. D. Pamington, adv. b., rev. charts, illus., tr.lit., index, circ 3,200, Indexed: Br. tech. Ind. Chem. Abstr. RAPRA, (ISSN 0034-3617).

URETHANE PLASTIC AND PRODUCTS - 1971, m. $30, Technomic Publishing Co., Inc., 265 Post Rd. W. Westport, CT 06880., Ed. M. Kohudic, bk. rev. charts, illus., circ. 700, (looseleaf format), (ISSN 0049-5700).

Encyclopedia of Associations
17th Ed. 1983

Plastic Adhesive and Sealant Mfrs.
Coun., Rubber and (ASC)
1600 Wilson Blvd., Suite 910
Arlington, VA 22209

Amer. Soc. of Electroplated Plastics (ASEP)
1000 Vermont Ave., N.W.
Washington, DC 20005

Plastic Art; Intl. Assn. of
33 W. 67th St.
New York, NY 10023

Assn. of Rotational Molders (ARM)
221 N. LaSalle St.
Chicago, IL 60601

Chemical Fabrics and Film Assn. (CFFA)
1230 Keith Bldg.
Cleveland, OH 44115

Plastic Container Mfrs. Inst. (PCMI)
804 Broadway
West Long Branch, NJ 07764

Cultured Marble Inst. (CMI)
435 N. Michigan Ave., Suite 1717
Chicago, IL 60611

Plastic Fabricators; Nat;. Assn. of (NAPF)
1701 N. St., N.W.
Washington, DC 20036

Plastic and Metal Products Mfrs. Assn. (PMPMA)
225 W. 34th St.
New York, NY 10001

Plastic Modelers Soc., U.S. Br., Intl. (IPMS/USA)
P.O. Box 7704
Long Beach, CA 90807

Natl. Assn. of Plastic Distributors (NAPD)
Gilson Rd.
Jaffrey, NH 03452

Plastic and Novelty Workers' Union;
Intl. Leather Goods (ILGPNWU)
265 W. 14th St.
New York, NY 10011

Orgn. of Plastic Processors (TOPP)
53 Church St.
Stonington, CT 06378

Plastic Pipe and Fittings Assn (PPFA)
999 N. Main St.
Glen Ellyn, IL 60137

Plastic in Construction Coun. (PICC)
c/o Society of the Plastics Industry
355 Lexington Ave.
New York, NY 10017

Polyurethane Mfrs. Assn (PMA)
999 N. Main St., Suite 203
Glen Ellyn, IL 60137

Plastics and Reconstructive Surgeons;
Amer. (ASPRS)
Soc. of
233 N. Michigan Ave., Suite 1900
Chicago, IL 60601

Reinforced Plastics/Composites Inst. (RP/CI)
355 Lexington Ave.
New York, NY 10017

Soc. of the Plastics Industry (SPI)
355 Lexington Ave.
New York, NY 10017

Society of Women in Plastics (SWP)
P.O. Box 8125
Riverview, MI 48192

Plastic Soft Materials Mfrs. Assn (PSMMA)
225 W. 34th St.
New York, NY 10001

Urethane Foam Contractors Assn. (UFCA)
1406 Third National Bldg.
Dayton, OH 45402

Urethane Inst., Soc. of the Plastics Industry (UISPI)
355 Lexington Ave.
New York, NY 10017

Plastic Workers of America; United Rubber, Cork,
Linoleum, and (URW)
87 S. High St.
Akron, OH 44308

Plastics Education Found (PEF)
c/o Maurice Keroack
1913 Central Ave.
Albany, NY 12205

Plastic Engineers; Soc. of (SPE)
14 Fairfield Dr.
Brookfield Center, CT 06805

Plastic Inst. of America (PIA)
Stevens Institute of Technology
Castle Point Station
Hoboken, NJ 07030

Plastic Pipe Inst. (PPI)
355 Lexington Ave.
New York, NY 10017

Plastic Processor's Orgn. of (TOOP)
53 Church St.
Stonington, CT 06378

Plastic Research in Dentistry; Amer, Acad. for (AAPRD)
211 South St.
Davison, MI 48423

New Associations

New Plastic Pipe Assn; Uni-Bell (UNI-BELL)
2655 Villa Creek
Dallas, TX 75234

Plastic Shipping Container Inst. (PSCI)
150 N. Wacker Dr., Suite 2400
Chicago, IL 60606

General Equipment List

QUANTITY	ITEM
2	Steel Cabinets for Supplies
1	Rack for Plastic Sheets, Rods, Film, Etc.
1	Rack for Reference Material
1	Air Compressor 1 HP min. with Regulator, Hose, and Nozzles
1	Vent System as Dictated by Facility
1	Shop-Vac HP min.
1	Combination Hex and Wrench Set 1/4" - 1 1/4"
2	6" Adjustable Wrenches
2	12" Adjustable Wrenches
1	AlVen Wrench Set
1	10" Vise Grip Wrench
1	5" Vise Grip Wrench
1	6" Portable Hand Saw

QUANTITY	ITEM
4	3/8" Vari-Speed Electric Hand Drills
1	Router with Bits
1	Variable Speed Jig Saw
1	Table Saw 10" with Dado Plate & Abrasive Blades and Guards
1	6" Jointer
1 or 2	14" Band Saw or 24" Scroll Saw
2	12" Wood Lathes with tools and Guards
1	Combination 6" Belt and 12" Disc Grinder and Sander
1	6" Bench Grinder
4	2 Wheel Buffers 1725 Max. RPM, with ¾"x 8" Buffing Wheel
1 or 2	15" Variable Speed Drill Press
1	24" Plastic Strip Heater
1	Plastic Oven with Rotational Casting Unit
1	Set Abrasive Drums 1/2" - 3"
1	Safety Glasses Storage Cabinet and Cleaner with 25 Pair Safety Glasses
1 or 2	Wash Fountain with Eye Flush
2	Asbestos Gloves

Plastic Equipment List

ROTATIONAL MOLDING OVEN
(has dual use as high temperature oven)

Specifications:

Outside Dimension 22"w, 19"d, 22"h
2" Insulation
Controlled Heat 100 to 550 Degrees F°
Cal Rod Heating Element 110 VAC 1000 W
Fan Forced Air Circulation
2 AXIS Rotational Unit
Several Associated Molds

HIGH TEMPERATURE BENCH OVEN

Specifications:

Overall size 21"w, 19"d, 24"h
Temperature Control 0-400 F°
110-120 VAC 11.6 AMP
1.2 kw Heater
Inside Shelves
Full Insulation

COMPRESSION MOLDER

Specifications:

Water Cooled
Platen Heaters 900 w. each 1800 w. total
110 VAC
Indicator Lamps
Temperature Controls 100-600 F°
Hydraulic Pressure 40,000 lbs.
Platen Size 8" x 8"
Several Associated Molds

AUTOMATIC
VACUUM-PRESSURE FORMER

Specifications:

12" x 20" Sheet Size
22" of Hg, Suction
36 PSIG, Pressure
1 hp + 4 Vane Pump
Heaters 3000 w. 4/750 Elements
115 VAC
Blow Height to 7"
Draw Depth to 4"

INJECTION MOLDER

Specifications:

Shot Capacity 1 oz
Power 100 VAC
Heaters 400 w
RAM Diameter 1"
Mold Size 3" x 3 1/2" x 8"
Temperature Range 100 to 600 F°
Vise Locking, Screw Type
Several Associated Molds

HOT AIR WELDER

Specifications;

Heater 350-1000 F°
110 VAC
Compressed Air Regulator Control
Round Tip
High Speed Welding Tip

BUFFERS

Specifications:

1/3 hp Motor 1725 RPM
110 VAC
1/2" Shaft
Dust Covers, Safety Shields
meet OSHA Standards

HEAT GUNS

Specifications:

110 Volts
14 amps
Nozzle Temp. 750 F°
Air Velocity 9 CFM

STRIP HEATER

Specifications:

30" Length
110 VAC
400 w
On/Off Pilot Lamp

POLYSTYRENE BEAD COOKER

Specifications:

Size 12" x 13" x 23"
Stainless Steel
Associated Molds

DRI COATER

Specifications:

Capacity 12"w x 14"d x 18"h
Pilot Light
Pressure Regulator
110 VAC 10 AMP

BLOW MOLDER

Specifications:

Utilities
Power 110 VAC, 20 AMPS
Compressed Air 20 psi
Domestic Water
Extruded Specifications
3/4" Screw 20 to 1 L/D Ratio
Two Temperature Control Zones
General Specifications:
500 w on Barrel
275 w on Head
Clamping Pressure 750 psi
Platen Size 5 1/2" x 5 1/2"
Mold Size 4" x 6"
Platen Opening 7 1/2"
Associated Molds

EXTRUSION MOLDING

Specifications:

48" Long Extrusion Bed
1/2 Hp Motor, Fan Cooled
400 inch - lb. Torque
110 VAC 10 AMP
17 to 1 L/D
3/4" dia. Screw for Soft Plastic
3 Heater Bonds both Barrel and Die
Temperature Control
Water Cooled Barrel Head
Variable Speed, Solid State Control
Several Associated Dies

PLASTIC GRINDER

Plastics Tool List (Hand Tools)

Recommended tool list for a class of 20 students

QUANTITY	ITEM
5	12 Locker Bench Unit with 4 Vises each
20	Bench Stops
1	Tap & Die Set
10	6" Try Squares
5	24" Carpenter Squares
3	12" Combination Squares
2	Screwdriver Sets with Standard & Phillips
5	Back Saws
10	Coping Saws with Replacement Blades
2	Hand Crosscut Saws
2	Hand Rip Saws
10	24" Wooden Rules
2	10" Steel Tapes
3	Inside Calipers
3	Outside Calipers
5	Dividers
3	Center Punches
3	Combination Pliers
3	Diagonal Cutter Pliers
3	Long Nose Pliers
5	Jack Planes or Smooth Planes
1	Block Plane
1	Miter Box Saw
3	Nail Sets
3	6" Marking Gauger
5	Mallets
1	24" Level
5	3" Sloyd Knives

QUANTITY	ITEM
5	Putty Knives
5	Utility Knives
1	Hole Saw
3	Hand drills
5	7" Standard Nail Hammers
3	Hack Saws with Replacement Blades
1	Drill Gauge
10	Round Files
10	Flat Files
5	Tile Cards
20	File Handles
1	First Aid Kit
3	Counter Sinks
10	Handscrew Clamps
20	6" Spring Clamps
2	Sets Wood Chisels
1	Set Cold Chisels
1	Set Hand Carving Tools
5	Bench Brushes
10	Scratch Awls
3	T-bevels
2	Power Bit Sets
2	Sets Twist Drills 1/16" - 1/2"
2	Circular Plastic Cutting Blades
5	Floor Brushes
1	Tool Storage Cabinet for above items

Vendors of Plastic Supplies

Ain Plastics
249 East Sandford Boulevard
Post Office Box 151
Mt. Vernon, New York 10550

Arrowhead Plastics
1946 Foxridge Drive
Kansas City, Kansas 66106

B. C. MacDonald Co.
510 Southwest Boulevard
Kansas City, Kansas 66103

Brodhead-Garrett
4560 East 71st Street
Cleveland, Ohio 44105

Cadillac Plastics
9025 Lenexa Drive
Lenexa, Kansas 64108

Cope Plastics, Inc.
6340 Knox Industrial Drive
St. Louis, Missouri 63139

Delvie's Plastics, Inc.
133 West Haven Avenue
Post Office Box 1415
Salt Lake City, Utah 84110

Dow Corning Corporation
Midland, Michigan 48690

Gilbert & Miller
239 New Main Street
Yonkers, New York 10701

Iasco
5724 West 36th Street
Minneapolis, Minnesota 55416-2594

Paxton-Patterson
5719 West 65th Street
Chicago, IL 60638

Pitsco, Inc.
Box 1328
Pittsburg, Kansas 66762

Regal Plastic Supply Company
2023 Holmes
Kansas City, Missouri 66103

Vendors of Plastic Equipment

GENERAL

IASCO
5724 West 36th Street
Minneopolis, MN 55416-2594

Brodhead-Garrett
4560 East 71st Street
Cleveland, OH 44105

Paxton-Patterson
5719 W. 65th Street
Chicago, IL 60638

Plastic & Equipment Sales Inc.
1825 Holste Road
Northbrook, IL 60062

SATCO
924 South 19th Ave
Minneapolis, MN 55404

COMPRESSION-TRANSFER PRESSES

Bipel International, Inc.
20 Nutmeg Dr.
Trumbull, CN 06611

Fred S. Carver, Inc.
1 Chatham Rd.
Summitt, NJ 07901

Dake Corporation
390 Robbins Rd.
Grand Haven, MI 49417

Hull Corporation
3579 Davisville Rd.
Hatboro, PA 19040

Morgan Industries, Inc.
3311 E. 59th St.
Long Beach, CA 90805

Pasadena Hydraulics
202 N. Berry St.
Brea, CA 92621

Stokes Equipment Div.
Pennwalt Corporation
5500 Tabor Rd.
Philadelphia, PA 19120

Wabash Metal Products Company
1500 Morris St.
Wabash, IN 46992

INJECTION MACHINES

Hinchman Manufacturing Company
259 E. 1st Ave.
Roselle, NJ 07203

McNeil-Akron-McNeil Corporation
96 E. Crosier St.
Akron, OH 44311

Morgan Industries, Inc.
3311 E. 59th St.
Long Beach, CA 90805

Newbury Industries, Inc.
P.O. Box 9
Newbury, OH 44065

Package Machinery Company
Reed-Prentice Division
East Longmeadow, MA 01028

Polymer Machinery Corporation
60 Woodlawn Rd.
Berlin, CN 06037

Simplomatic Manufacturing Company
4416 W. Chicago Ave.
Chicago, IL 60651

Van Dorn Plastic Machinery Company
2685 E. 79th St.
Cleveland, OH 44104

EXTRUDERS

Davis-Standard-Goulding Division
Crompton & Knowles Corporation
112 Water St.
Mystic, CN 06355

Killion Extruders
54 Depot St.
Verona, NJ 07044

Prodex Division
Koehring Company
King George Post Rd.
Fords, NJ 08863

Sterling Extruder Corporation
901 Dunham Ave.
South Plainfield, NJ 07080

BLOW-MOLDING MACHINES

Rocheleau Tool and Die Company
650 N. Main St.
Leominster, MA 01453

Stokes Equipment Div.
Pennwalt Corporation
5500 Tabor Rd.
Philadelphia, PA 19120

GRANULATORS

Cumberland Engrg. Company, Inc.
Box 6065
Providence, RI 02904

IMS Company
24050 Commerce Park Rd.
Cleveland, OH 44122

Nelmor Company, Inc.
Rivulet St.
North Uxbridge, MA 01538

THERMAL WELDERS

Brian R. White Company, Inc.
15158 Golden West Circle
Westminster, CA 92683

Kamweld Products Company
90 Access Road
Norwood, MA 02062

THERMAL IMPULSE SEALERS

Vertrod Corporation
2041 Utica Ave.
Brooklyn, NY 11234

ULTRASONIC WELDERS

Branson Sonic Power
Eagle Rd.
Danbury, CN 06810

HIGH-FREQUENCY WELDING EQUIPMENT

Wilcox and Gibbs
Thermatron Division
60 Spence St.
Bayshore, NY 11706

THEROFORMERS

AAA Plastic Equipment Company, Inc.
2509 W. Berry
Fort Worth, TX 76109

Comet Industries, Inc.
1324 N. York Rd.
Bensenville, IL 60106

CHOPPER GUN

Glas-Craft of California
9145 Glen Oaks Blvd.
Sun Valley, CA 91352

Glas-Mate Division
Ransburg Electro-Coating Corporation
3501 NW 9th Ave.
Ft. Lauderdale, FL 33309

Venus Products, Inc.
1866 Ives Ave.
Kent, WA 98031

FOAM-DISPENSING EQUIPMENT

Glas-Craft of California
9145 Glen Oaks Blvd.
Sun Valley, CA 91352

Martin Sweets Co.
3131 W. Market St.
Louisville, KY 40212

MARKING EQUIPMENT

Admiral Coated Products, Inc.
Empire Blvd.
Moonachie, NJ 07074

Kensol-Olsenmark Company
40 Melville Park Rd.
Melville, NY 11746

Kingsley Machine Co.
Cahuenga Blvd. at Willoughby Ave.
Hollywood, CA 90038

OVENS

Blue M. Engineering Company
9650 Telstar Ave.
El Monte, CA 91731

The Grieve Corporation
511 Hart Rd.
Round Lake, IL 60073

TESTING EQUIPMENT

Comten Industries
1415 Third St.
St. Petersburg, FL 33731

W. C. Dillon and Company
14620 Keswick St.
Van Nuys, CA 91407

Instron Corporation
2505 Washington
Canton, MA

Thwing-Albert Instrument Company
10960 Dutton Rd.
Philadelphia, PA 19154

Tinius-Olsen
2100 Easton Rd.
Willow Grove, PA 19090

Metric Tables

CONVERSION TABLE
ENGLISH TO METRIC

WHEN YOU KNOW:	MULTIPLY BY: * = Exact		TO FIND:
	VERY ACCURATE	APPROXIMATE	
LENGTH			
inches	* 25.4		millimetres
inches	* 2.54		centimetres
feet	* 0.3048		metres
feet	* 30.48		centimetres
yards	* 0.9144	0.9	metres
miles	* 1.609344	1.6	kilometres
WEIGHT			
grains	15.43236	15.4	grams
ounces	* 28.349523125	28.0	grams
ounces	* 0.028349523125	.028	kilograms
pounds	* 0.45359237	0.45	kilograms
short ton	* 0.90718474	0.9	tonnes
VOLUME			
teaspoon		5.0	millilitres
tablespoon		15.0	millilitres
fluid ounces	29.57353	30.0	millilitres
cups		0.24	litres
pints	* 0.473176473	0.47	litres
quarts	* 0.946352946	0.95	litres
gallons	* 3.785411784	3.8	litres
cubic inches	* 0.016387064	0.02	litres
cubic feet	* 0.028316846592	0.03	cubic metres
cubic yards	* 0.764554857984	0.76	cubic metres
AREA			
square inches	* 6.4516	6.5	square centimetre
square feet	* 0.09290304	0.09	square metres
square yards	* 0.83612736	0.8	square metres
square miles		2.6	square kilometre
acres	* 0.40468564224	0.4	hectares
TEMPERATURE			
Fahrenheit	*5/9 (after subtracting 32 from F. temp.)		Celsius

BEST COPY AVAILABLE

Identification Tests for Thermoplastic Materials

Resin		Burning	Heating in a Test Tube for Odor	Melting Point °F (°C)
Acetal	plastic burns — not self-extinguishing	Blue flame; no smoke; drippings may burn	Formaldehyde	347 (175)
Acrylate & Methacrylate		Blue flame; yellow top	Fruit-like	374* (190)
Acrylic - rubber modified		Yellow flame; spurts	Characteristic [3]	279 (137)
Acrylonitrile - Butadiene - Styrene		Yellow flame; black smoke; drips	Characteristic [3]	—
Acrylonitrile - Styrene		Yellow flame; black smoke; clumps of carbon in air	Illuminating gas and acrylonitrile	268 (131)
Cellulose Acetate		Yellow flame; sparks; drippings may burn	Acetic Acid	[4] 446 (230)
Cellulose Acetate Butyrate		Blue flame; yellow tip; sparks; drippings may burn	Rancid butter	[4] 356 (180)
Cellulose Nitrate		White flame; very rapid	Sharp	Decomposes
Cellulose Propionate		Blue flame; yellow tip; sparks; drippings may burn	Fragrant	[4] 456 (236)
Cellulose Triacetate		Yellow flame; drips	Acetic Acid	572 (300)
Ethyl Cellulose		Yellow flame; blue top; drippings may burn	Burned sugar	—
Ethylene		Blue flame; yellow top; drippings may burn	Paraffin	221 (105) low density
				248 (120) high density
Methylstyrene		Yellow flame; black smoke; clumps of carbon in air; softens	Illuminating Gas	349 (176)
Polyester Films		Yellow flame; smokes; drips	Characteristic [3]	482 (250)
Propylene		Blue flame; yellow top; swells and drips	Sweet	334 (168)
Styrene		Yellow flame; dense smoke; clumps of carbon in air	Illuminating Gas	374 (190)
Styrene - Methylmethacrylate		Yellow flame; smoke	Characteristic [3]	351 (177)
Vinyl Acetate		Yellow flame; smoke	Acetic Acid	140 to 190 (60 to 88)
Vinyl Alcohol		Yellow flame; smoke	Characteristic [3] Initially soapy	446 (230) Decomposes
Vinyl Butyral		Blue flame; yellow top; melts and drips; drippings may burn	Rancid Butter	[4] 345 (174)
Vinyl Chloride - Vinyl Acetate	plastic [1] burns	Yellow flame with green	Hydrochloric Acid [2]	261 (127)
Carbonate		Decomposes	—	430 (221)
Chlorinated Ether	plastic burns — self-extinguishing	Sputtering; bottom green; top yellow black smoke; carbon in air	Characteristic [3]	358 (181)
Nylon		Blue flame; yellow top; melts and drips	Burned wool	
66 nylon ZYTEL® 101				489 (254)
ZYTEL 42				489 (254)
610 nylon ZYTEL 31				415 (213)
6 nylon ZYTEL 211				405 (207)
11 nylon Rilsan				351 (177)
alcohol soluble nylon ZYTEL 63				311 (155)
ZYTEL 69				293 (145)
Vinyl Chloride Polymers[2]		Yellow flame; green at edges; softens and chars	Hydrochloric Acid	302 (150)
Vinylidene Chloride Polymers		Yellow flame; ignites with difficulty; green spurts	Hydrochloric Acid	313 (156)
Fluorocarbons				
FEP	plastic does not burn	Deforms	—	554 (290)
TFE				621 (327)
Fluorohydrocarbons				
Vinylidene Fluoride Polymers		—	—	340 (171)
Fluorochlorocarbons		Deforms; slight melting; drips	Weak acetic acid	383 (195)

Resin	Cold CCl_4	Acetone	Warm Ethanol	Benzene	$CHCl_3$	Cold 4.2M HCl	Boiling 4.2M HCl	90% Formic Acid	Special Solvents	Specific Gravity @ 23°C.	Examples of Materials
Acetal	I	I	I	I	I	—	—	—	—	1.42 -1.43	DELRIN®[1]
Acrylate & Methacrylate	I	S	I	S	S	—	—	—	Toluene	1.18 -1.19	LUCITE®[1]
Acrylic - rubber modified	I	PS	I	S	PS	—	—	—	Partially soluble in esters	1.12 -1.16	IMPLEX [2]
Acrylonitrile - Butadiene - Styrene	PS	—	I	PS	S	—	—	—	Esters & ethylene dichloride	1.04	CYCOLAC [3]
Acrylonitrile - Styrene	I	S	—	—	—	—	—	—	Methyl ethyl ketone	1.08 -1.06	TYRIL [5], FOSTACRYL [6], LUSTRAN A [5]
Cellulose Acetate	—	S	—	I	S	—	—	—	Acetic Acid	1.25 -1.35	
Cellulose Acetate Butyrate	PS	S	I	—	S	—	—	—	—	1.17 -1.24	TENITE BUTYRATE[9]
Cellulose Nitrate	I	S	—	—	PS to I	—	—	—	Esters & aliphatic hydrocarbons	1.34 -1.40	XYLONITE [10]
Cellulose Propionate	S	S	—	—	S	—	—	—	Esters	1.20 -1.24	FORTIFLEX [11]
Cellulose Triacetate	—	S	—	—	—	—	—	—	Dioxane	1.27 -1.28	B X TRIACETATE [10]
Ethyl Cellulose	—	S	S	I	S	—	—	—	Some hot aromatics Benzene - Toluene	1.10 -1.16	ETHOCEL [7]
Ethylene	I	I	I	I	I	I	I	I	Some hot aromatics	914- 930	ALATHON®[1]
	I	I	I	I	I	I	I	I	Benzene - Toluene	94 - 96	
Methylstyrene	—	S	—	S	S	—	—	—	Esters & some chlorinated hydrocarbons	1.03	CYMAC 400[1]
Polyester Films	I	I	I	I	I	I	I	—	Metacresol and hot nitrobenzene	1.38 -1.40	MYLAR®[1]
Propylene	I	I	I	I	I	I	I	I	Some hot aromatics Benzene - Toluene	85 - 91	ALATHON®[1]
Styrene	—	S	—	S	S	—	—	—	Esters	1.04 -1.08	DYLENE [12]
Styrene - Methylmethacrylate	—	S	—	S	S	—	—	—	—	1.14	ZERLON [13]
Vinyl Acetate	—	S	—	—	—	—	—	—	Cyclohexanol	1.18 -1.20	ELVACET®[1]
Vinyl Alcohol	I	I	—	I	I	—	—	—	Hot water	1.27 -1.31	ELVANOL®[1]
Vinyl Butyral	I	I	S	I	I	—	—	—	Esters, PS	1.07 -1.20	BUTACITE®[1]
Vinyl Chloride - Vinyl Acetate	—	S	I	—	S	—	—	—	Cyclohexanone	1.34 -1.37[2]	VELON [14]
Carbonate	PS	PS	I	PS	S	—	—	—	—	1.2	LEXAN [4]
Chlorinated Ether	I	I	I	I	I	I	I	I	—	1.4	PENTON [4]
Nylon											
66 nylon ZYTEL® 101	I	I	I	I	I	I	S	S	—	1.14 -1.15	ZYTEL®[1]
ZYTEL 42	I	I	I	I	I	I	S	S	—	1.14	
610 nylon ZYTEL 31	I	I	I	I	I	I	I	S	—	1.09	
6 nylon ZYTEL 211	I	I	I	I	I	S	S	S	—	1.13	
11 nylon Rilsan	I	I	I	I	I	I	I	I	—	1.04	
alcohol soluble nylon ZYTEL 63	I	I	S	I	I	S	S	S	Hot 80% aqueous ethanol	1.08	
ZYTEL 69	I	I	S	I	I	S	S	S		1.08	
Vinyl Chloride Polymers[2]	I	—	I	—	—	—	—	—	Cyclohexanone	1.30 -1.60	EXON [16], VIPLA [17]
Vinylidene Chloride Polymers	—	PS	I	—	—	I	I	—	—	1.63 -1.73	SARAN [15]
Fluorocarbons											
FEP	I	I	I	I	I	I	I	I	—	2.10 -2.19	TEFLON®[1]
TFE	I	I	I	I	I	I	I	I		2.14 -2.17	TEFLON[1]
Fluorohydrocarbons											
Vinylidene Fluoride Polymers	—	S	—	—	—	—	—	—	Dimethyl acetamide	1.76	KYNAR [17]
Fluorochlorocarbons	I	I	I	I	I	I	I	I	Dimethyl acetamide	2.1	KEL-F [13]

[1] Some compositions burn slowly, others are self-extinguishing

[2] Will vary between grades 6, 7 or 8

[3] Plasticizers will usually lower specific gravity and/or may mask odor

[4] Odors are difficult to describe, but recognizable — use controls (Known sample)

[5] Wide range of melting points, depending upon composition

S — Soluble
I — Insoluble
PS — Partially Soluble

1. E. I. du Pont de Nemours & Co. (Inc.)
2. Rohm and Haas Co.
3. Marbon Chemical Div., Borg-Warner Corp.
4. American Cyanamid Co.
5. The Dow Chemical Co.
6. Foster Grant Co.
7. General Electric Co.
8. Hercules Powder Co.
9. Eastman Chemical Products, Inc.
10. BX Plastics Ltd.
11. Celanese Plastics Co.
12. Koppers Co.
13. Minnesota Mining and Manufacturing Co.
14. Chemore Corp.
15. Dayton Industrial Products Co.
16. Firestone Plastics Co.
17. Pennsalt Chemical Co.
18. Monsanto Company

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Plastics Tables

L-1

SPECIFIC GRAVITY OF PLASTICS

Specific gravity is the ratio of the weight of a material compared to the weight of an equal volume of water.

POLYMER	SPECIFIC GRAVITY
1. Acetal	1.42
2. Acrylic	1.18
3. Acrylonitrile Butadiene Styrene	1.04
4. Cellulose Acetate	1.30
5. Diallyl Phthalate	1.34–1.78
6. Epoxy (cast)	1.11
7. Ionomer	0.93–0.96
8. Melamine Formaldehyde	1.48
9. Nylon	1.13–1.20
10. Phenol Formaldehyde	1.25–1.30
11. Phenoxy	1.17
12. Polyallomer	0.89–0.90
13. Polycarbonate	1.20
14. Polyester	1.01–1.20
15. Polyethylene, L. D.	0.91–0.92
16. Polyethylene, H. D.	0.94–0.96
17. Polyphenylene Oxide	1.08
18. Polypropylene	0.89–0.90
19. Polystyrene	1.04–1.10
20. Polysulfone	1.24
21. Polyurethane	1.11–1.25
22. Polyvinyl Chloride	1.16–1.35
23. Silicone	1.75
24. Tetrafluoroethylene	2.14–2.20

L-2

COMPRESSIVE STRENGTH OF PLASTICS

The compression force required to rupture or deform a given specimen.

POLYMER	psi
1. Epoxy	35,000
2. Phenol Formaldehyde	34,000
3. Melamine Formaldehyde	30,000
4. Cellulose Acetate	28,000
5. Polyester	25,000
6. Diallyl Phthalate	23,000
7. Polyurethane	20,000
8. Acrylic	16,000
9. Polyphenylene Oxide	16,000
10. Polystyrene	15,000
11. Silicone	15,000
12. Polysulfone	13,900
13. Acetal	13,000
14. Nylon	13,000
15. Polycarbonate	12,500
16. Phenoxy	11,000
17. Polyvinyl Chloride	11,000
18. Acrylonitrile Butadiene Styrene	10,000
19. Ionomer	8,000
20. Polypropylene	7,000
21. Polyallomer	4,000
22. Polyethylene, H. D.	3,200
23. Polyethylene, L. D.	2,300
24. Tetrafluoroethylene	1,700

L-3

TENSILE STRENGTH OF PLASTICS

The force necessary to pull the specimen apart.

POLYMER	psi
1. Polyester (glass filled)	30,000
2. Silicone (asbestos filled)	28,000
3. Epoxy (glass filled)	17,000
4. Nylon	15,000
5. Polysulfone	10,200
6. Polyphenylene Oxide	9,600
7. Polycarbonate	9,500
8. Acrylic	9,000
9. Acetal	8,800
10. Phenol Formaldehyde	8,500
11. Phenoxy	8,500
12. Melamine Formaldehyde	8,300
13. Cellulose Acetate	8,000
14. Acrylonitrile Butadiene Styrene	7,000
15. Polystyrene	7,000
16. Diallyl Phthalate	6,000
17. Polyurethane	6,000
18. Polypropylene	5,300
19. Polyethylene, H. D.	5,000
20. Tetrafluoroethylene	5,000
21. Polyvinyl Chloride	4,800
22. Ionomer	4,000
23. Polyallomer	3,500
24. Polyethylene, L. D.	2,000

L-4

WATER ABSORPTION OF PLASTICS

1/8 in. thick sample over 24 hour period.

POLYMER	PERCENT ABSORBED
1. Tetrafluoroethylene	0.00
2. Polyallomer	0.01
3. Polyethylene, H. D.	0.01
4. Polypropylene	0.01
5. Polyethylene, L. D.	0.015
6. Polystyrene	0.04
7. Polyphenylene Oxide	0.06
8. Epoxy	0.10
9. Silicone	0.12
10. Phenoxy	0.13
11. Polycarbonate	0.15
12. Acetal	0.22
13. Polysulfone	0.22
14. Acrylic	0.30
15. Ionomer	0.30
16. Acrylonitrile Butadiene Styrene	0.35
17. Diallyl Phthalate	0.35
18. Melamine Formaldehyde	0.35
19. Polyvinyl Chloride	0.40
20. Polyester	0.55
21. Phenol Formaldehyde	0.60
22. Polyurethane	0.80
23. Nylon	1.50
24. Cellulose Acetate	3.80

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L-5

IMPACT STRENGTH

The mechanical energy absorbed by a standard test sample during fracture by a blow from a pendulum hammer. Comparison values.

POLYMER	FOOT POUNDS
1. Polycarbonate	8.0
2. Polyvinyl Chloride	5.5
3. Polyurethane	5.0 to flexible
4. Acrylonitrile Butadiene Styrene	4.2
5. Phenol Formaldehyde	4.0
6. Ionomer	3.5
7. Polyallomer	3.2
8. Polyethylene, H. D.	3.0
9. Tetrafluoroethylene	3.0
10. Polyphenylene Oxide	2.4
11. Cellulose Acetate	2.2
12. Polypropylene	2.0
13. Polysulfone	1.9
14. Phenoxy	1.8
15. Nylon	1.5
16. Acetal	1.4
17. Epoxy	1.0
18. Polyester	0.8
19. Polystyrene	0.7
20. Diallyl Phthalate	0.5
21. Acrylic	0.33
22. Melamine Formaldehyde	0.30
23. Polyethylene, L. D.	flexible
24. Silicone	flexible

L-6

CONTINUOUS RESISTANCE TO HEAT IN DEGREES FAHRENHEIT WHILE IN USE

POLYMER	TEMPERATURE IN DEG. F.
1. Acetal	220
2. Acrylic	180
3. Acrylonitrile Butadiene Styrene	200
4. Cellulose Acetate	180
5. Diallyl Phthalate	425
6. Epoxy	400
7. Ionomer	220
8. Melamine Formaldehyde	210
9. Nylon	325
10. Phenol Formaldehyde	450
11. Phenoxy	170
12. Polyallomer	210
13. Polycarbonate	250
14. Polyester	250
15. Polyethylene, L. D.	200
16. Polyethylene, H. D.	250
17. Polyphenylene Oxide	375
18. Polypropylene	300
19. Polystyrene	170
20. Polysulfone	325
21. Polyurethane	200
22. Polyvinyl Chloride	175
23. Silicone	600
24. Tetrafluoroethylene	550

L-7

NATURAL COLOR OF PLASTIC MOLDING COMPOUNDS

POLYMER	COLOR
1. Acetal	Light Tan Opaque
2. Acrylic	Crystal Clear
3. Acrylonitrile Butadiene Styrene	Light Tan Opaque
4. Cellulose Acetate	Clear
5. Diallyl Phthalate	Gray Opaque
6. Epoxy	Clear
7. Ionomer	Clear
8. Melamine Formaldehyde	Gray Opaque
9. Nylon	Off White Opaque
10. Phenol Formaldehyde	Dark Gray Opaque
11. Phenoxy	Crystal Clear
12. Polyallomer	Milky White
13. Polycarbonate	Clear
14. Polyester	Clear
15. Polyethylene, L. D.	Milky White
16. Polyethylene, H. D.	Milky White
17. Polyphenylene Oxide	Opaque Beige
18. Polypropylene	Milky White
19. Polystyrene	Crystal Clear
20. Polysulfone	Amber Clear
21. Polyurethane	Opaque Amber
22. Polyvinyl Chloride	Light Bluish Clear
23. Silicone	Variable
24. Tetrafluoroethylene	White Opaque

L-8

AVERAGE COMPRESSION MOLDING TEMPERATURES

POLYMER	UNITS IN DEG. F.
1. Acetal	350
2. Acrylic	325
3. Acrylonitrile Butadiene Styrene	350
4. Cellulose Acetate	280
5. Diallyl Phthalate	300
6. Epoxy	300
7. Ionomer	325
8. Melamine Formaldehyde	325
9. Nylon	500
10. Phenol Formaldehyde	325
11. Phenoxy	350
12. Polyallomer	300
13. Polycarbonate	450
14. Polyester	300
15. Polyethylene, L. D.	300
16. Polyethylene, H. D.	300
17. Polyphenylene Oxide	425
18. Polypropylene	350
19. Polystyrene	300
20. Polysulfone	550
21. Polyurethane	425
22. Polyvinyl Chloride	350
23. Silicone	325
24. Styrene Acrylonitrile	325

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L-9 BAND SAWING PLASTICS

POLYMER	TYPE OF BLADE	TEETH PER INCH	SPEED (FT. PER MIN.)
Acetal	Metal	10–16	1500
Acrylic	Metal	5–7	2000–4000
Acrylonitrile Butadiene Styrene	Wood–Skip Tooth	5–7	1000–3000
Cellulose Acetate	Wood–Skip Tooth	4–6	1000–1500
Diallyl Phthalate	Metal	10–18	2000
Epoxy (Filled)	Metal	10–18	1500
Ionomer	Wood–Skip Tooth	4–6	1000–1500
Melamine Formaldehyde	Metal	10–18	2000
Nylon	Wood–Skip Tooth	4–6	1000
Phenol Formaldehyde	Metal	10–18	1500
Polyallomer	Wood–Skip Tooth	4–6	1200–1500
Polycarbonate	Metal	10–18	1500
Polyester	Metal	10–18	4000
Polyethylene	Wood–Skip Tooth	4–6	1200–1500
Polyphenylene Oxide	Wood–Skip Tooth	6–9	2000–3000
Polypropylene	Wood–Skip Tooth	4–6	1200–1500
Polystyrene	Metal	10–18	3000–4000
Polysulfone	Metal	6–9	2000–3000
Polyurethane (Rigid)	Wood–Skip Tooth	4–6	1000–2000
Polyvinyl Chloride	Metal	6–9	2000–3000
Tetrafluoroethylene	Wood–Skip Tooth	5–7	1200–1500

L-10 MACHINING PROPERTIES OF MOLDED PLASTICS

POLYMER	RATING
1. Acetal	Excellent
2. Acrylic	Good
3. Acrylonitrile Butadiene Styrene	Good to Excellent
4. Cellulose Acetate	Excellent
5. Diallyl Phthalate	Fair
6. Epoxy	Fair
7. Ionomer	Good
8. Melamine Formaldehyde	Fair
9. Nylon	Excellent
10. Phenol Formaldehyde	Fair to Good
11. Phenoxy	Excellent
12. Polyallomer	Good
13. Polycarbonate	Excellent
14. Polyester	Good
15. Polyethylene, L. D.	Good
16. Polyethylene, H. D.	Excellent
17. Polyphenylene Oxide	Excellent
18. Polypropylene	Good
19. Polystyrene	Good
20. Polysulfone	Excellent
21. Polyurethane	Fair to Excellent
22. Polyvinyl Chloride	Excellent
23. Silicone	Fair
24. Tetrafluoroethylene	Excellent

L-11 TYPICAL FILLERS USED IN PLASTICS

POLYMER	FILLER
Acetal	Glass fibers, TFE fibers
Acrylonitrile Butadiene Styrene	Glass fibers
Diallyl Phthalate	Glass fibers
Epoxy	Clay, silica, glass fibers, metal powders
Melamine Formaldehyde	Flock, asbestos, fabric, glass fibers, cellulose fibers
Nylon	Glass fibers, asbestos
Phenol Formaldehyde	Wood flour, asbestos, mica, glass fibers, cotton flock, metal powders
Polycarbonate	Glass fibers
Polyester	Clay, glass fibers, woven cloth, asbestos
Polyethylene	Asbestos, metal powders
Polyphenylene Oxide	Glass fibers
Polypropylene	Asbestos, glass fibers
Polystyrene	Glass fibers
Polyvinyl Chloride	Asbestos, clay
Silicone	Asbestos, glass fiber, quartz
Urea Formaldehyde	Cellulose fibers, asbestos

L-12

COMMON SOLVENT CEMENTS FOR THERMOPLASTICS

RESIN	SOLVENT CEMENT
Acrylic	Methylene Chloride Ethylene Dichloride
ABS	Methyl Ethyl Ketone
* Cellulosics	Methyl Alcohol Methyl Ethyl Ketone
Ethyl Cellulose	Ethylene Dichloride
Polycarbonate	Methylene Chloride
Polyphenylene Oxide	Chloroform Toluene Ethylene Dichloride
Polystyrene	Methyl Ethyl Ketone Methylene Chloride
Polyvinyl Chloride	Tetrahydrofuran

(* Cellulose acetate and cellulose acetate butyrate)

L-13

DRILL SPEED AND POINT ANGLE FOR DRILLING PLASTICS WITH STANDARD TWIST DRILLS

POLYMER	SPEED (rpm)	POINT ANGLE IN DEGREES
Acetal	300–800	118
Acrylic	1500–2500	95
Acrylonitrile Butadiene Styrene	500–900	118
Cellulose Acetate	1000–2000	90
Diallyl Phthalate	600–2000	90
Epoxy (Filled)	500–1000	118
Ionomer	300–800	95
Melamine Formaldehyde	600–2000	90
Nylon	900–1500	70–90
Phenol Formaldehyde	600–2000	90
Polyallomer	1000–3000	90
Polycarbonate	300–800	118
Polyester	500–2000	90
Polyethylene	1000–3000	70–90
Polyphenylene Oxide	500–900	100
Polypropylene	1000–3000	70–90
Polystyrene	1500–2500	95
Polysulfone	1000–2500	95
Polyurethane (Rigid)	1000–3000	70–90
Polyvinyl Chloride	900–2000	116
Tetrafluoroethylene	1000–2000	90

L-14

CIRCULAR SAWING PLASTICS

POLYMER	TYPE OF BLADE	TEETH PER INCH	SPEED (FT. PER MIN.)
Acetal	Hollow Ground	4–6	8000
Acrylic	Hollow Ground	3–4	3000
Acrylonitrile Butadiene Styrene	Combination	4–6	4000
Cellulose Acetate	Combination	4–6	3000
Diallyl Phthalate	Carbide Tip	8–10	2000
Epoxy (Filled)	Carbide Tip	8–10	3000
Ionomer	Hollow Ground	6–8	6000
Melamine Formaldehyde	Carbide Tip	8–10	5000
Nylon	Hollow Ground	8–10	5000
Phenol Formaldehyde	Carbide Tip	8–10	3000
Polyallomer	Hollow Ground	4–6	9000
Polycarbonate	Hollow Ground	4–6	8000
Polyester	Carbide Tip	8–10	5000
Polyethylene	Hollow Ground	4–6	9000
Polyphenylene Oxide	Hollow Ground	6–8	5000
Polypropylene	Hollow Ground	8–10	9000
Polystyrene	Hollow Ground	4–6	2000
Polysulfone	Hollow Ground	3–4	3000
Polyurethane (Rigid)	Hollow Ground	3–4	4000
Polyvinyl Chloride	Hollow Ground	4–6	3000
Tetrafluoroethylene	Hollow Ground	4–6	8000

NOTE: Softer polymers, such as polyethylene, are more easily and accurately cut on a squaring shear.

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L-15

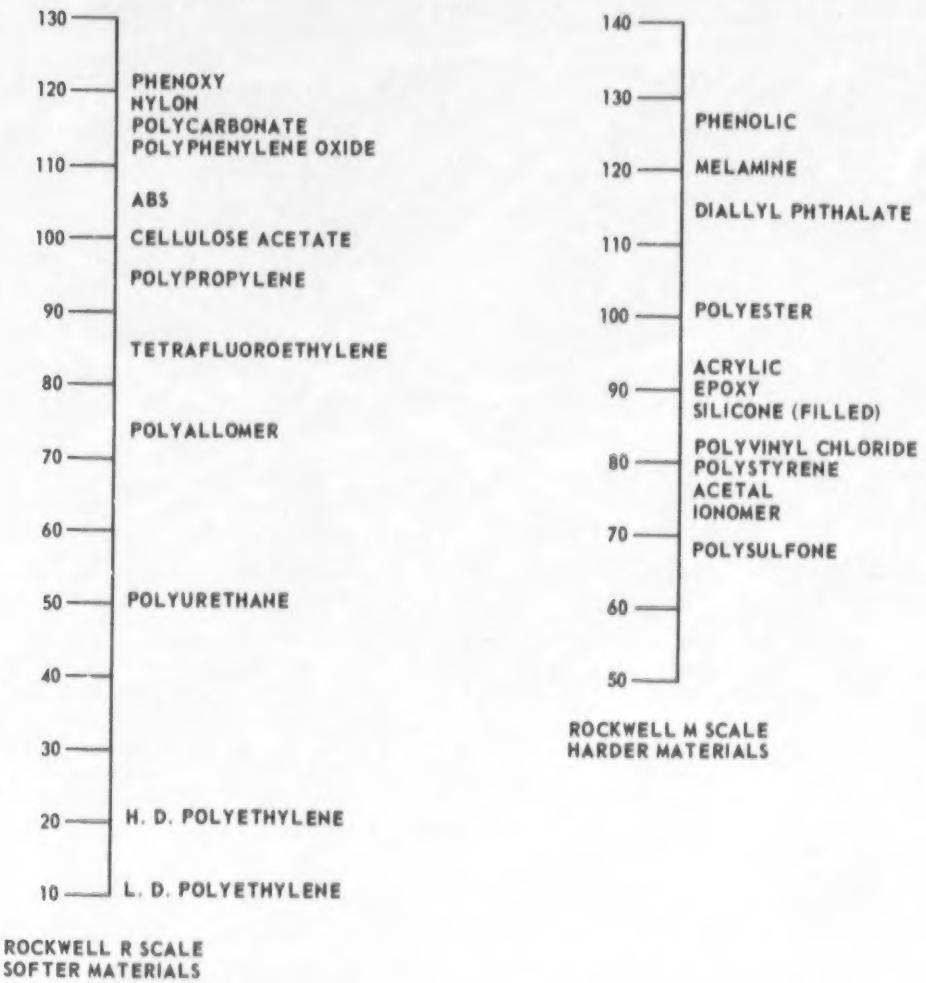
CHARACTERISTICS OF PLASTIC FOAMS

POLYMERS	DENSITY LBS./CU.FT.	TYPE	CELL STRUCTURE	AVAILABLE FORM	CHARACTERISTIC USES
ABS	31.0–62.0	Thermoplastic, rigid.	Closed	Pellets	Picture frames, ice buckets, wall plaques.
Cellulose Acetate	6.0–8.0	Thermoplastic, rigid.	Closed	Boards and rods.	Life buoys, aircraft floats, fuel tank floats.
Epoxy	2.0–23.0	Thermoset, rigid.	Closed	Liquid and precast sheets and blocks.	Acoustical insulation, refrigerator doors, pontoons, gun stocks, furniture.
Ionomer	2.0–20.0	Thermoplastic, flexible.	Closed	Sheets and rods.	Marine floats, gaskets, insulation, packaging.
Phenolic	0.1–22.0	Thermoset, rigid.	Open and closed.	Liquid foam–in–place resin.	Cores for boat hulls, pipe insulation, cores for plywood, insulation.
Polyethylene	2.0–35.0	Thermoplastic, rigid.	Closed	Sheets, rods, tubing, molded parts.	Package cushioning, life jackets, boat bumpers, gaskets.
Polystyrene	1.0–10.0	Thermoplastic, rigid.	Closed	Expanded beads, boards and blocks.	Hot and cold drink cups, packaging, food containers, insulation.
Polyurethane	1.5–70.0	Thermoset, flexible or rigid.	Open and closed	Foam–in–place liquids, boards and blocks.	Freezer insulation, marine flotation, furniture cushioning, packaging.
Polyvinyl Chloride	3.0–45.0	Thermoplastic, flexible or rigid.	Open and closed	Sheets, molded shapes, and expandable beads.	Thermal insulation, athletic gear, ice buckets, flooring, carpet backing.
Silicone	9.6–31.0	Thermoset, rigid or flexible.	Open and closed.	Liquid and sheet.	Plastic surgery, heat sealing blankets, sponges.

L-16

HARDNESS OF PLASTICS MOLDING COMPOUNDS

A COMPARISON OF A PLASTICS RESISTANCE TO INDENTATION



Chronology of Plastics

(Early Experimenters of Plastic)

1833	J.J. Berzelius	First Synthetic Compound
1835	H.V. Reynault	Synthesized Vinyl Chloride
1860	Michael Faraday	Used Gutta Percha, Elect Insulation
1862	Alexander Parks	Nitrocellulose
1868	John W. Hyatt	Developed Celluloid
1897	W. Krischa	Produced Casein from Milk
1897	Adolf Spittler	Urea Formaldehyde
1909	Leo Hendrik Baekeland	Discovered and Patented Bakelite

Introduction of Plastics Materials

DATE	MATERIAL	TYPICAL USE
1868	Cellulose Nitrate	Eye Glass Frames
1909	Phenol-Formaldehyde	Telephone Handset
1909	Cold Molded	Knobs and Handles
1919	Casein	Knitting Needles
1926	Alkyd	Electrical Bases
1926	Analine-Formaldehyde	Terminal Boards
1927	Cellulose Acetate	Tooth Brushes, Packaging
1927	Polyvinyl Chloride	Rain Coats
1929	Urea-Formaldehyde	Lighting Fixtures
1935	Ethyl Cellulose	Flashlight Cases
1936	Acrylic	Brush Backs, Displays
1936	Polyvinyl Acetate	Flash Bulb Lining
1938	Cellulose Acetate Butyrate	Irrigation Pipe
1938	Polystyrene or Styrene	Kitchen Housewares
1938	Nylon (Polyamide)	Gears
1938	Polyvinyl Acetal	Safety Glass Interlayer
1939	Polyvinylidene Chloride	Auto Seat Covers
1939	Melamine-Formaldehyde	Tableware
1942	Polyester	Boat Hulls
1942	Polyethylene	Squeezable Bottles
1943	Fluorocarbon	Industrial Gaskets
1943	Silicone	Motor Insulation
1945	Cellulose Propionate	Automatic Pens and Pencils
1947	Epoxy	Tools and Jigs
1948	Acrylonitrile-Butadiene-Styrene	Luggage
1949	Allylic	Electrical Connectors
1954	Polyurethane or Urethane	Foam Cushions
1956	Acetal	Automative Parts
1957	Polypropylene	Safety Helmets
1957	Polycarbonate	Appliance Parts
1959	Chlorinated Polyether	Valves and Fittings
1962	Phenoxy	Bottles
1962	Polyallomer	Typewriter Cases
1964	Ionomer	Skin Packages
1964	Polyphenylene Oxide	Battery Cases
1964	Polyimide	Bearings
1964	Ethylene-Vinyl Acetate	Heavy Gauge Flexible Sheeting
1965	Parylene	Insulating Coatings
1965	Polysulfone	Electrical/Electronic Parts
1970	Thermoplastic Polyester	Electrical/Electronic Parts
1973	Polybutylene	Piping
1975	Nitrile Barrier Resins	Containers

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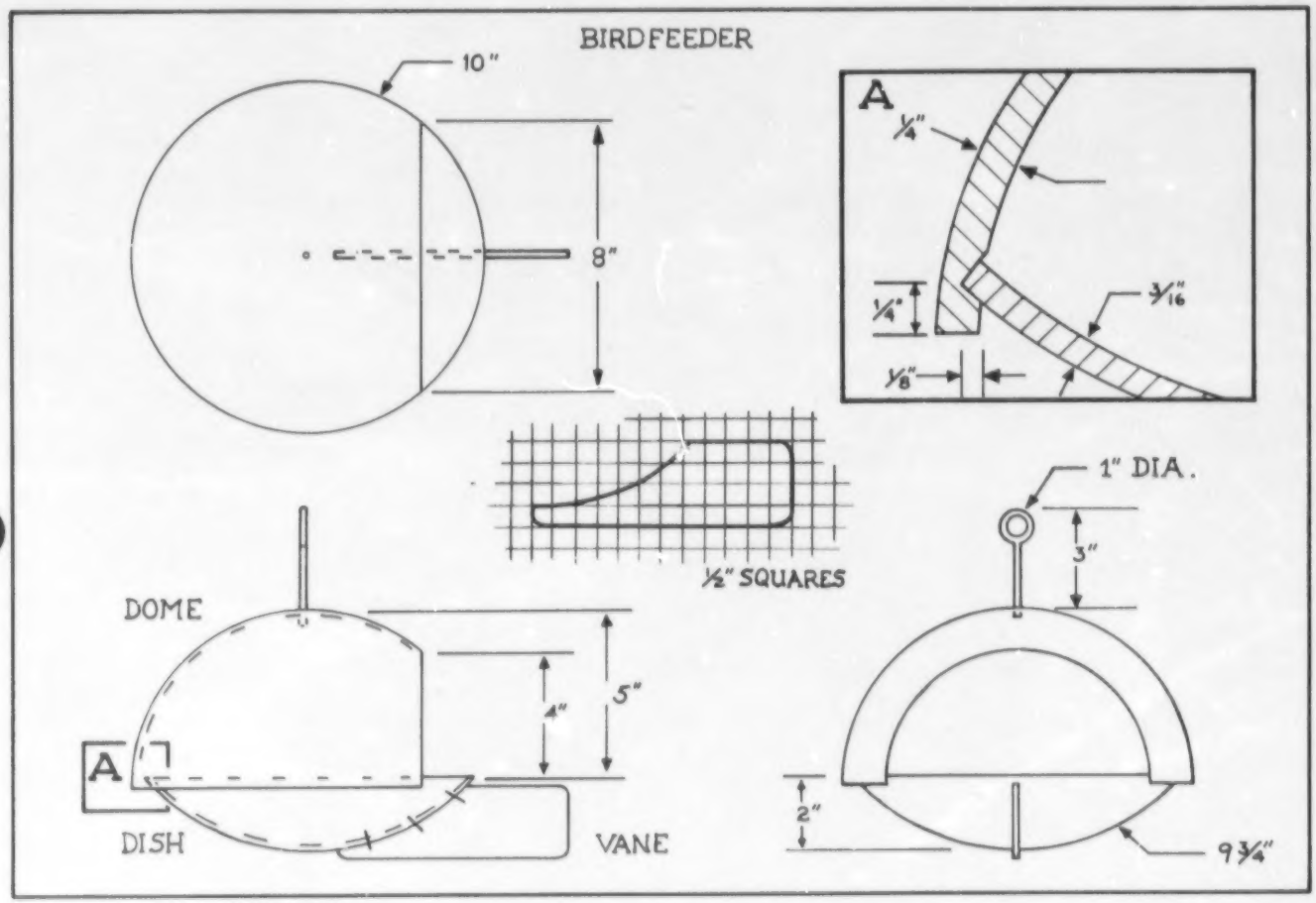
THERMOFORMING

PURPOSE: To demonstrate the method of production utilizing the free blowing technique. The designated product design will give the student additional experience in cutting, drilling, shaping, fastening, and finishing plastic parts.

PRODUCT DESIGN:



OBJECTIVES: Upon the completion of this activity the student will be able to:

1. relate free blow forming to the thermoforming family of shaping techniques
2. discuss the various methods of tooling
3. identify and design necessary jigs on fixtures to facilitate the production of the product design
4. perform the tasks of cutting, drilling, shaping, free blowing, fastening and polishing sheet plastic
5. calculate the materials necessary to manufacture the product and develop a cost analysis of the product, machine time, labor and materials
6. develop marketing techniques for the product

LEARNING ACTIVITIES:

1. make a list of many thermoformed products; industrial and consumer
2. build a free blow former for the stated product design
3. design/build the associated template, jigs, and fixtures to complete the product design
4. discuss the employment opportunities and requisites

DEMONSTRATION:

Bench oven
Compressed air supply
Band saw
Free blowing form
Drill press and drills
Screw drivers
Filer and Abrasives

MATERIALS:

1. 1/4" x 12" x 12" Acrylic (clear)
2. 3/16" x 12" x 12" Acrylic (colored)
3. (3) #4 x 5/8" FH screws
4. 1/8 x 10 Brass rod
5. 1 Brass washer

PROCEDURES:

1. Prepare tooling for free blowing
2. Fashion template, jigs, and fixtures
3. Cut acrylic sheets to 12" diameters
4. Preheat oven to 350°F
5. Form clear acrylic to 5" high dome (5-10 PSI)
6. Form colored acrylic to 2" deep dish (5-10 PSI)
7. Trim waste flange
8. Route snap-fit groove into clean dome
9. Cut opening into clear acrylic dome
10. Reheat waste piece cut from dome and return (plastic memory) to original sheet condition.
11. Lay out wind vane and cut according to template
12. File, abrate and polish all cut edges of dome, dish and vane
13. Drill holes for:
    1. Hanger hole in dome
    2. Drain hole in dish
    3. Screw shank holes in dish
    4. Screw pilot holes in vane
14. Fashion brass hanger rod
15. Assemble dish and vane
16. Assemble dome and dish/vane
17. Package for consumer
18. Submit to instructor for evaluation

FIELD TRIP SUGGESTIONS:

Sign shop
Thermoforming plant
Container manufacturer
Pattern making shop
Department store (for displays of consumer products)

AUDIO VISUAL AIDS:

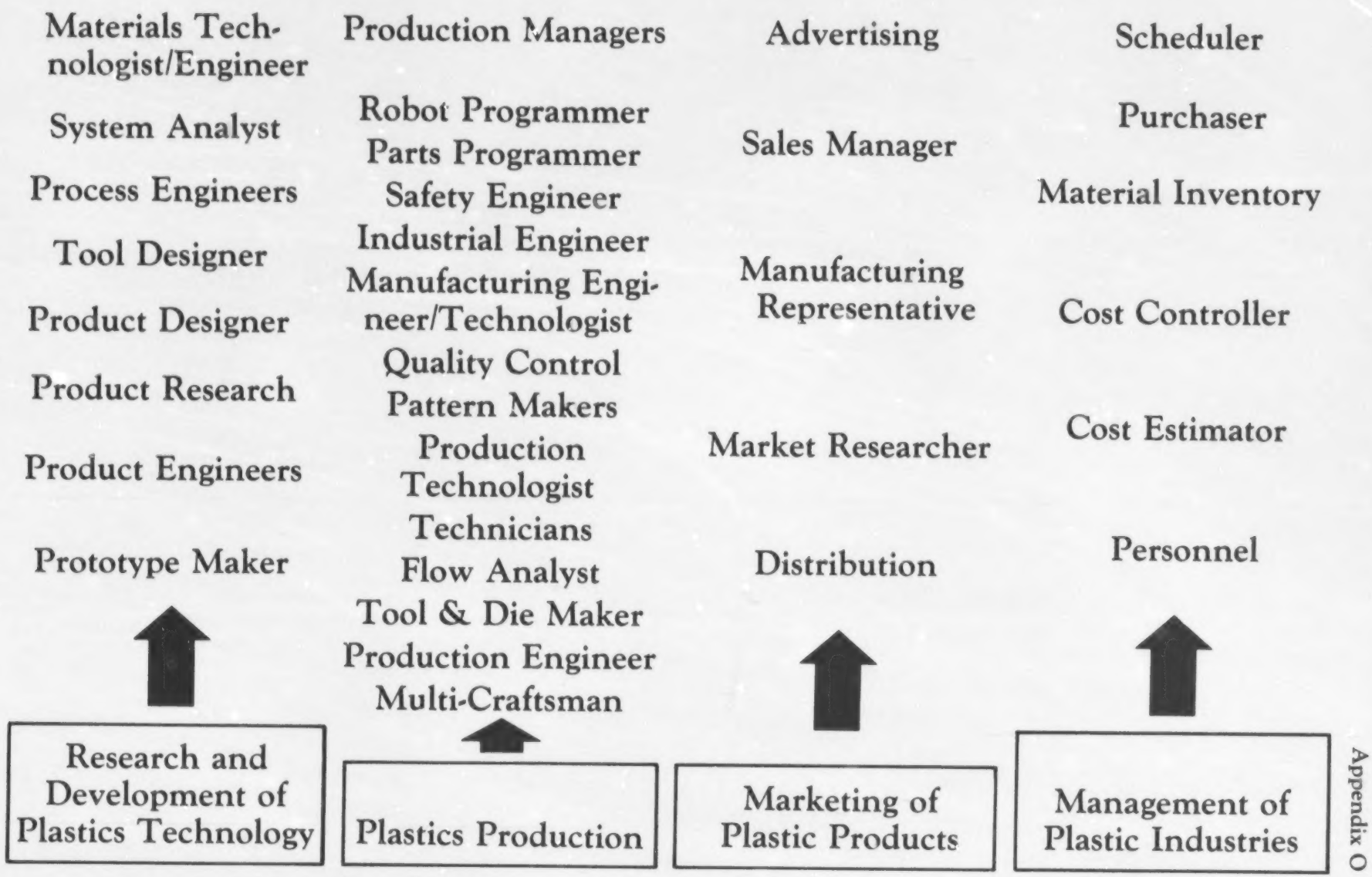
"The World of Acrylics" 16 mm

"Thermoforming" Slide Cassette

EVALUATION:

1. Teacher-made informational achievement test
2. Evaluation criteria developed by teacher for laboratory procedures

Manufacturing Career Patterns for Corporate Leaders in the Plastics Industry



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Major Competency Profile

Directions: This profile provides a permanent record for student and instructor. The competencies listed below represent the tasks to be performed in the Demonstration Lessons presented in Units I-IX. Compile your evaluation of the student by transferring the appropriate "yes/no" rating from the various lessons to this sheet.

YES	NO	**Plastic Industry in Perspective**
☐	☐	1. Define the term "plastic"
☐	☐	2. Identify natural materials used in the production of plastics.
☐	☐	3. Define the list of plastic terms.
☐	☐	4. Define the "Age of Plastics."

YES	NO	**Synthetic Material Technology**
☐	☐	1. Identify the specific plastic samples
☐	☐	2. Satisfactorily perform the following tests on plastic materials:
☐	☐	a. burn test
☐	☐	b. specific gravity test
☐	☐	c. tensile test
☐	☐	d. compression test
☐	☐	e. water absorption test
☐	☐	f. impact test
☐	☐	g. hardness test
☐	☐	3. List and describe 5 of the 7 tests you performed on plastic materials.

YES	NO	**Product Design**
☐	☐	1. Successfully pass the "History of Plastics" test.
☐	☐	2. Sketch a working drawing of a mold.
☐	☐	3. Examine and compare permanent to non-permanent molds.
☐	☐	4. Define the sand casting process.
☐	☐	5. Make a sand cast mold.
☐	☐	6. Pour the sand casting with aluminum.
☐	☐	7. Complete plastic mold with your aluminum mold.
☐	☐	8. Make an epoxy mold.
☐	☐	9. Make a cast gypsum cement mold.
☐	☐	10. List the woods most commonly used to make molds.
☐	☐	11. Make a wooden mold.
☐	☐	12. Pour the mold with RTV silicone.

YES	NO	**Finishing & Decorating Plastics**
☐	☐	1. List the smoothing and polishing operations.
☐	☐	2. Describe equipment available to finish plastics in shop.
☐	☐	3. Polish and/or smooth the acrylic sample.
☐	☐	4. Define the tumbling of plastics.
☐	☐	5. Use the tumbler to finish the acrylic sample.
☐	☐	6. Describe the electroplating of plastics.
☐	☐	7. Define the vacuum metalizing of plastics.
☐	☐	8. Describe the engraving of plastics.
☐	☐	9. List the advantages and disadvantages of painting plastics.
☐	☐	10. Paint the plastic project.
☐	☐	11. Describe the silk screen printing of plastics.
☐	☐	12. Silk screen a plastic item.
☐	☐	13. Define the in-moid decorating process.
☐	☐	14. Describe the hot stamping process.
☐	☐	15. Orally report on plastic fasteners.
☐	☐	16. List the different types of heat sealing.
☐	☐	17. Describe the snap-fit mechanical fasteners.
☐	☐	18. List applications for plastic threads.
☐	☐	19. Describe metal and plastic spring clips.
☐	☐	20. Rivet sheet plastic material.
☐	☐	21. Identify colorants used in plastics.
☐	☐	22. Define annealing and postcuring.

YES	NO	**Plastic Converters (Forming Technique I)**
☐	☐	1. Name material used for injection molding.
☐	☐	2. List procedure steps in the injection molding process.
☐	☐	3. Define the extrusion process.
☐	☐	4. List three types of extruded plastics.
☐	☐	5. Perform the extrusion forming process.
☐	☐	6. Describe the blow molding process.
☐	☐	7. Make the blow molded project.
☐	☐	8. Define compression and transfer molding.
☐	☐	9. Explain differences between compression & transfer molding.
☐	☐	10. Perform the compression molded lab assignment.
☐	☐	11. Identify items produced by slush forming.
☐	☐	12. Make a slush formed item.
☐	☐	13. List the processes using dry plastics.
☐	☐	14. Describe the basic steps in rotational molding.
☐	☐	15. Define static molding.
☐	☐	16. Describe the spray coating process.
☐	☐	17. Put a fluidized-bed coating on your project.
☐	☐	18. List industrial processes.
☐	☐	19. Define expanded plastic.
☐	☐	20. List principal methods of producing foaming plastics.
☐	☐	21. Describe expanded-bead molding.
☐	☐	22. Make a project with the expanded bead molding process.
☐	☐	23. Name the two groups of bonding plastics.
☐	☐	24. Bond two pieces of plastic together.
☐	☐	25. List the processes used in the welding of plastics.
☐	☐	26. Define fusion welding.
☐	☐	27. Perform the fusion welding lab assignment.
☐	☐	28. Define friction welding.
☐	☐	29. Perform the friction welding lab assignment.
☐	☐	30. List resins most suited to hot gas welding.
☐	☐	31. Describe/define the hot gas welding process.
☐	☐	32. List the most commonly used gas in hot gas welding.
☐	☐	33. Make filler rods.
☐	☐	34. Perform the hot gas welding lab assignment.
☐	☐	35. Define the ultrasonic welding of plastics.
☐	☐	36. Define heat sealing.
☐	☐	37. Perform the heat sealing lab assignment.
☐	☐	38. List the heat sealing processes.
☐	☐	39. Describe the heat sealing processes.
☐	☐	40. List the steps in the calendering process.
☐	☐	41. Define the laminating process, with a sketch.
☐	☐	42. List materials used in the laminating process.
☐	☐	43. Define compreg laminating.
☐	☐	44. Perform the laminating lab assignment.
☐	☐	45. Define reinforced molding of plastics.
☐	☐	46. List the types of materials used in reinforced plastics.
☐	☐	47. Define open molding.
☐	☐	48. Define closed molding.
☐	☐	49. Describe the "lay up" process.
☐	☐	50. Perform the lay up (by hand) of the reinforced plastic lab assignment.
☐	☐	51. Describe the thermoforming of plastic sheet goods.
☐	☐	52. List the different processes which use the thermoforming plastic sheet goods.
☐	☐	53. Define the matched mold process.
☐	☐	54. List procedure steps for the matched molding process.
☐	☐	55. Perform the matched molding lab assignment.
☐	☐	56. Define the vacuum forming process.
☐	☐	57. List the machines used to vacuum form plastics.
☐	☐	58. Describe different applications of vacuum formed plastics.
☐	☐	59. Describe the plug assist vacuum forming technique.
☐	☐	60. Perform the plug assist lab assignment.
☐	☐	61. Define pressure forming.
☐	☐	62. Describe the straight pressure forming process.
☐	☐	63. Perform the pressure forming lab assignment.
☐	☐	64. Describe the free blowing process.
☐	☐	65. Describe an item which was blow formed.
☐	☐	66. List the most common method of machining plastics.
☐	☐	67. List the different ways to cut plastics.
☐	☐	68. Perform the plastic cutting lab assignment.
☐	☐	69. List the types of files used to shape plastics.
☐	☐	70. Define stamping, blanking and diecutting.
☐	☐	71. Describe the stopping and threading of plastics.
☐	☐	72. List the cutters used most often to cut plastics.
☐	☐	73. Draw a general purpose cutting tool for plastic, designating angles necessary to cut plastic.
☐	☐	74. Solve a problem dealing with feeds.
☐	☐	75. Describe the laser cutting process.
☐	☐	76. Practice stapling plastics.
☐	☐	77. Incorporate a plastic hinge in your project.

YES	NO	**Quantity Production Processes**
☐	☐	1. Define quantity production.
☐	☐	2. Write a report explaining economic reasons behind large quantity production of plastic products.

YES	NO	**People Power and the Plastics Industry**
☐	☐	1. Make a chart showing plastic industry occupations.
☐	☐	2. Participate in preparing an occupational analysis sheet.
☐	☐	3. Use the proper references when doing the research.
☐	☐	4. Review the findings.
☐	☐	5. Give the presentation.

YES	NO	**Plastic Industry in Perspective, Revisited**
☐	☐	1. Outline past/present status of the plastics industry.
☐	☐	2. Compare usage of plastic in pounds from 1977-2000.
☐	☐	3. List ways in which plastics can replace conventional methods in the construction field.
☐	☐	4. List plastic parts on today's cars.
☐	☐	5. Describe how plastic will help conserve our natural resources.
☐	☐	6. List the applications of plastics in the medical field.
☐	☐	7. Describe use of plastics in the aerospace industry.
☐	☐	8. List how plastics are used in the electronics/communication industries.
☐	☐	9. Participate in the class discussions.
☐	☐	10. Design a "new" plastic product.

Competency Certificate

This is to certify that:

_____

Achieved the major job competencies acknowledged on the reverse side for the program of

_____

And is therefore recognized

This _____ *Day of* _____, *19*_____

_____

_____ _____

Instructor *Administrator*